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London's Electricity Supply.

IN this issue we review the report of the London and Home Counties Joint Electricity Authority for 1927-1928, which relates to an important area of Great Britain, containing nearly 20 per cent. of the population and accounting for about 22 per cent. of the country's total sales of electricity. We are, of course, able only to deal with the report as a whole, but its main interest lies in the very complete details which are given for each individual undertaking. The figures reflect very clearly the effect of local conditions upon load factor, sales, revenue, costs and charges. With regard to capital expenditure, for instance, it is seen that while the local authorities with their compact areas have only expended 2.6 per cent. of the total upon main transmission lines, the companies show a proportion of 12.5 per cent. On the other hand, the local authorities have spent a larger proportion than the companies on generation and distribution.

The importance of the lighting and domestic load is apparent when it is reported that two-thirds of the revenue comes from this source although it accounts for only two-fifths of the sales of energy. Most of the undertakings have realised the remunerative nature of the load and are encouraging it by means of two-part tariffs, often in conjunction with schemes for the hire of apparatus. There are still several, however, which adhere to high flat rates, judging by the schedule of charges appended to the report, but they are a rapidly diminishing number. The poor load factors recorded by so many of the authorities (76 were under 30 per cent.) points to the need for intensive development rather than further extensions of supply. It will often be found far more profitable to encourage the existing consumers to make a better use of the electrical service than to connect up new customers.

The increase in the sales of energy during the period covered by the report was 21.0 per cent.; this compares favourably with the increase of 19.6 per cent. reported for the whole country. In some individual cases the advance was remarkable. The County of London Co., which of course is a special instance, showed an increase of 70.4 per cent. in sales. The Ascot and Brentford Companies recorded increases of 80.6 and 73.8 per cent., respectively. Among the municipalities the outstanding

advances were 53.7 per cent. in the case of Epsom and 33.6 per cent. in that of Woolwich. The extra-London companies as a whole showed the remarkable advance of 43.5 per cent., but this was mainly due to a 220 per cent. increase in the sales of the Kent Power Co. whose supply was nearly all purchased and re-sold for power purposes.

As regards charges, it will be observed that the municipalities were more favourable to the lighting and domestic consumer, the difference in the average prices charged by the two classes of undertaker being considerable. For other classes of supply the differences were not so great; the extra-London companies showed the lowest charge per kWh for power purposes. None of the municipal undertakings had to draw upon the rates; conversely, 21 of them contributed a total of £92,081 in relief of rates. Three of these—St. Pancras, West Ham and Woolwich—provided over £10,000 each. This fact, coupled with the satisfactory dividends recorded for the great majority of the company undertakings, shows that the London electricity supply industry is in a flourishing condition.

The Gasfilled Lamp Patent.

Much interest was taken, both in this country and abroad, in the application of the British Thomson-Houston Co., Ltd., for an extension of its patent for the gasfilled lamp. In granting the company a two years' extension a very fair review of the circumstances was made by Mr. Justice Luxmoore, who kept closely to the law and found that the company had undoubtedly suffered loss on account of the war.

As the company and its associates have been largely instrumental in making two lamps shine where one shone before (as Swift might have said) they have performed a public service and are entitled to the full reward which the war prevented them from receiving.

The I.E.E. Membership.

With respect to the complaint that the notice convening the special general meeting of corporate members of the Institution of Electrical Engineers (which was held immediately following the annual general meeting) for the purpose of sanctioning changes in the by-laws, was too short to allow the Council's proposals to be thoroughly examined, the fact must not be overlooked that a communication was issued to all members in November, 1928, outlining the proposed modifications. During two sessions the Council, with the assistance of the Membership, Examinations, and General Purposes Committees, and that of the Committees of the Local Centres as well, had devoted much consideration to the manner in which reclassification could best be carried out, and the sanctioning, almost unanimously, of the necessary amendments to the by-laws by the special meeting as reported last week, shows that a considerable measure of agreement had been reached.

Briefly, the major changes are as follows:—Normal admission to the class of Member will, in future, be *via* that of Associate Member. Chiefly, however, the regrouping has been deemed necessary because experience proved the Graduate class, which was formed in 1912, to be very unpopular, owing to its consisting of two very different types of men; that is to say, first, young engineers who have satisfied the Institution's educational requirements, but have not the requisite responsible practical experience for Associate Membership; and, secondly, engineers (not necessarily young) who although possessed of practical responsible experience in the profession, are never likely to pass the A.M.I.E.E. examination, which, incidentally, is to be known in future as the "Graduateship Examination." Hence the Council felt that the time had arrived when those two types should be separated, and accordingly the latter now become a non-corporate body of Associates.

A new class has been created. The old class of Associates contained a number of persons of distinction who were interested in, or connected with, the electrical profession and industry, but were not electrical engineers. They are now to be transferred to the new class designated Companions, and will be represented on the Council by one of their class, who will take the place of one of the two Associates who formerly served on that body. The chairman of the Wireless Section also becomes an *ex-officio* member of Council during his term of office. It is worthy of note that the honorary treasurership, vacated by resignation under the length of service rule, was not filled at the annual meeting, and it may be surmised that the new treasurer will probably be chosen from the new class of Companions, who must be eminent in their respective spheres and have "rendered important services to electrical engineering in the fields of commerce, finance, law, or science, or is so connected . . . . that his admission . . . . will conduce to the interests of the Institution."

The remainder of the by-law amendments relate to the re-admission of ex-enemy members, re-adjustment of age limits and subscriptions, and such other minor modifications as have been rendered necessary by the re-classification.

The North-East Coast Exhibition.

During a visit to the North-East Coast Exhibition, a review of the electrical exhibits of which we are concluding in this issue, we were impressed by the enthusiasm with which the N.E. Coast people have entered into the enterprise. The district has been particularly hard hit by the depression in the shipping industry, more so, probably, than is generally realised. The show is a bold effort to effect a trade recovery, and one of its principal objects is to entice new industries into the area. From this point of view it is perhaps a pity that more "outside" electrical manufacturers are not displaying their goods, although it must be said that the N.E. Coast firms have made a particularly good show.

One very encouraging fact is that the highly-developed electricity supply industry in the area is ready to supply the fundamental need of cheap power for any industrial enterprise that opens out in the area, and manufacturers should be close at hand to meet the demands for British plant.

The excellent general lighting arrangements throughout the Exhibition, which will, no doubt, play such an important part in making the venture a success, call for congratulation to all those who have put their energies into the enterprise, including Mr. H. W. Clothier, M.I.E.E., chairman, and his colleagues on the Electrical Committee, and the manufacturers and contractors.

High-voltage Underground Cables.

An announcement of unusual interest is made elsewhere in this issue. We refer to the statement in the timely and informative article signed by Mr. G. Martinez that two 132-kV lines, totalling 52 miles of single-core underground oil-filled cable, are shortly to be laid in London. Remembering the expressions of opinion relative to voltage limits made soon after the adoption of 33,000-volt cables in this country, one realises the truly compelling character of Hobson's choice. When anything really becomes an urgent necessity how soon the exceptional becomes acceptable!

Oil-filled 132-kV underground cables have been in operation in Italy and America for some time now, and although caution, within reason, is never unwise, whatever the future may be productive of in this direction it is probably hopeful. We are told that the London cables are to be installed as an experiment, but their manufacturers seem to have passed that stage, for they have accepted the contract at their own financial risk entirely and subject to stringent guarantees of replacement by cables designed to operate at lower voltages in the event of mishaps. It is to be hoped that their confidence has not been misplaced, and that they will reap the reward of their enterprise.

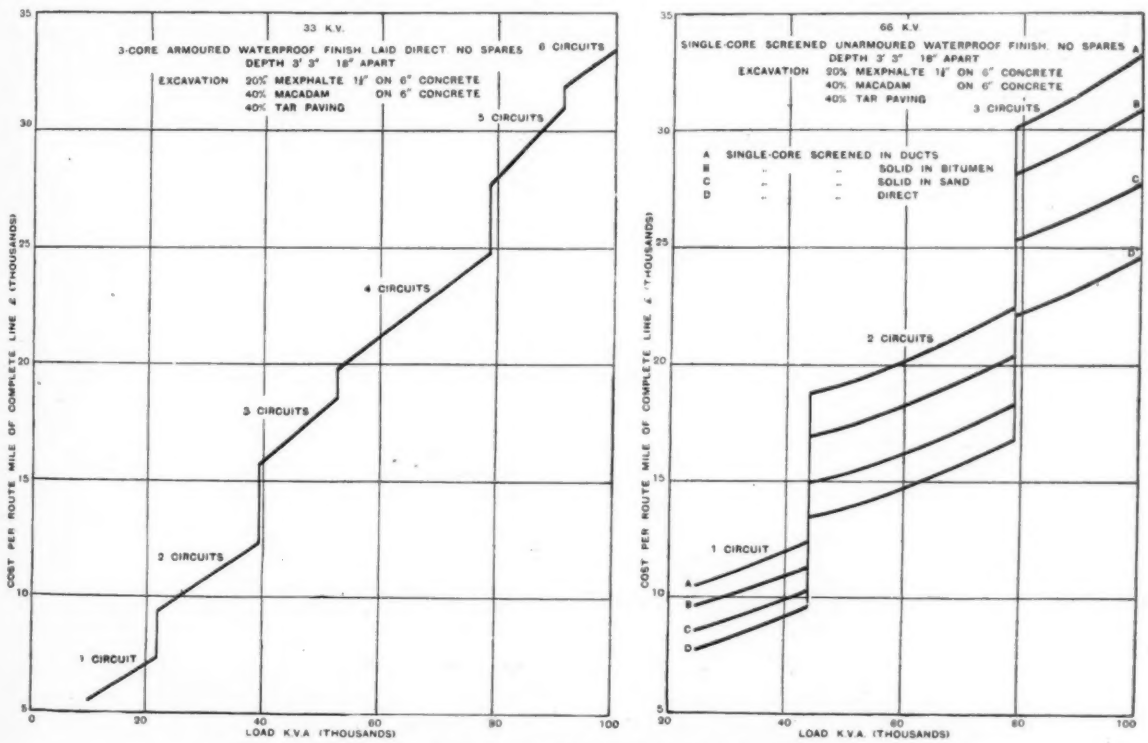
Underground Super-voltage Cables.

This article, dealing with the total cost per mile of completely installed underground cables, is of timely interest and assistance, especially in view of the fact that the six graphs represent in a clear and concise manner comparisons of practical importance.

By G. MARTINEZ, A.M.I.E.E.

FOR underground transmission lines up to and including 33 kV working pressure, the usual procedure is to lay one or more three-core armoured cables direct. The curves in fig. 1 show the total cost per mile of completely installed lines for 33 kV working pressure and of various carrying capacities; also the cross section of the trench required.

For working pressures higher than 33 kV, various systems of laying are commonly used, *i.e.*, (*a*) pulled into ducts; (*b*) laid in troughs, solid; (*c*) laid in troughs, with sand; and (*d*) laid direct with sand and protection slabs. The set of curves in fig. 2 shows the total cost per mile of completely installed lines of various carrying capacities at a pressure of 66 kV, laid on the four different systems mentioned above, and, further, the cross section of the trench to be excavated to accommodate the line, if the latter be laid direct.


33 K.V.
3-CORE ARMOURED WATERPROOF FINISH LAID DIRECT NO SPARES
DEPTH 3' 3" 18" APART
EXCAVATION 20% MEXPHALTE 1½" ON 6" CONCRETE
40% MACADAM ON 6" CONCRETE
40% TAR PAVING
1 CIRCUIT
2 CIRCUITS
3 CIRCUITS
4 CIRCUITS
5 CIRCUITS
6 CIRCUITS
COST PER ROUTE MILE OF COMPLETE LINE £ (THOUSANDS)
LOAD K.V.A. (THOUSANDS)
66 K.V.
SINGLE-CORE SCREENED UNARMOURED WATERPROOF FINISH NO SPARES
DEPTH 3' 3" 18" APART
EXCAVATION 20% MEXPHALTE 1½" ON 6" CONCRETE
40% MACADAM ON 6" CONCRETE
40% TAR PAVING
A SINGLE-CORE SCREENED IN DUCTS
B " " SOLID IN BITUMEN
C " " SOLID IN SAND
D " " DIRECT
1 CIRCUIT
2 CIRCUITS
3 CIRCUITS

Figs. 1 and 2.—Total Cost per Mile of 33-kV and 66-kV Cable Lines.

It is obvious that the direct-laying system is the cheapest. As regards mechanical protection of the cable, there is little to differentiate between the different systems of laying because none are proof against an iron stake or fencing pin being driven directly against the line; if however, the cable be laid at a sufficient depth to make the chance of this happening remote, the system of laying direct should be satisfactory if protection by means of suitable slabs be provided. Slabs used as top covers, however, will not, of course, protect the cable from a pick used below it from one side, as, for example, might happen when excavation work is being carried out along the cable route; the lower the cable can be laid, therefore, the safer it will be. The danger of flint working its way up to the cable can be to a great extent minimised by taking the necessary care in the filling of the trench.

With regard to the risk of attack by electrolysis, the duct system is certainly the worst. The laid-solid system is better, if the filling compound can be guaranteed to be non-brittle at the lowest temperature found in the soil. Practical experiment seems to indicate that direct laying in the ground with compounded-tape insulation over the lead is at least as good, if not better, than any other system, and provided reasonable bonding precautions are taken, no trouble from electrolytic phenomena should be experienced.

It is obvious that whatever the conditions the provision of a second lead sheath makes the cable much safer, as it is then possible to break up the return path of stray currents by arranging for the outer sheath of each length to be disconnected from those adjacent.

It seems right to conclude that the direct-laying system is the most practical, as it is cheaper and no more dangerous than the others. Why, then, should not a

33-kV cable be laid unarmoured direct in the ground? Fig. 3 shows a comparison of costs between a 33-kV three-core armoured cable (of the screened or triple-lead-

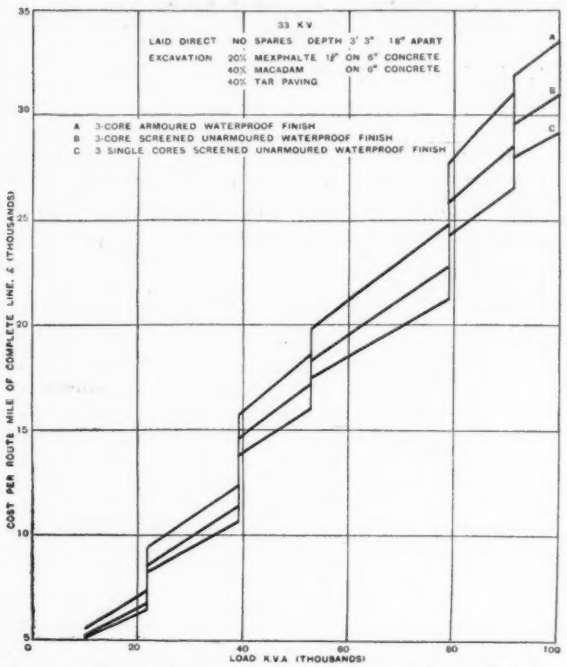

33 K.V.
LAID DIRECT NO SPARES DEPTH 3' 3" 18" APART
EXCAVATION 20% MEXPHALTE 1½" ON 6" CONCRETE
40% MACADAM ON 6" CONCRETE
40% TAR PAVING
A 3-CORE ARMOURED WATERPROOF FINISH
B 3-CORE SCREENED UNARMOURED WATERPROOF FINISH
C 3 SINGLE CORES SCREENED UNARMOURED WATERPROOF FINISH
COST PER ROUTE MILE OF COMPLETE LINE, £ (THOUSANDS)
LOAD K.V.A (THOUSANDS)

Fig. 3.—Cost Comparison of Various Types of Line.

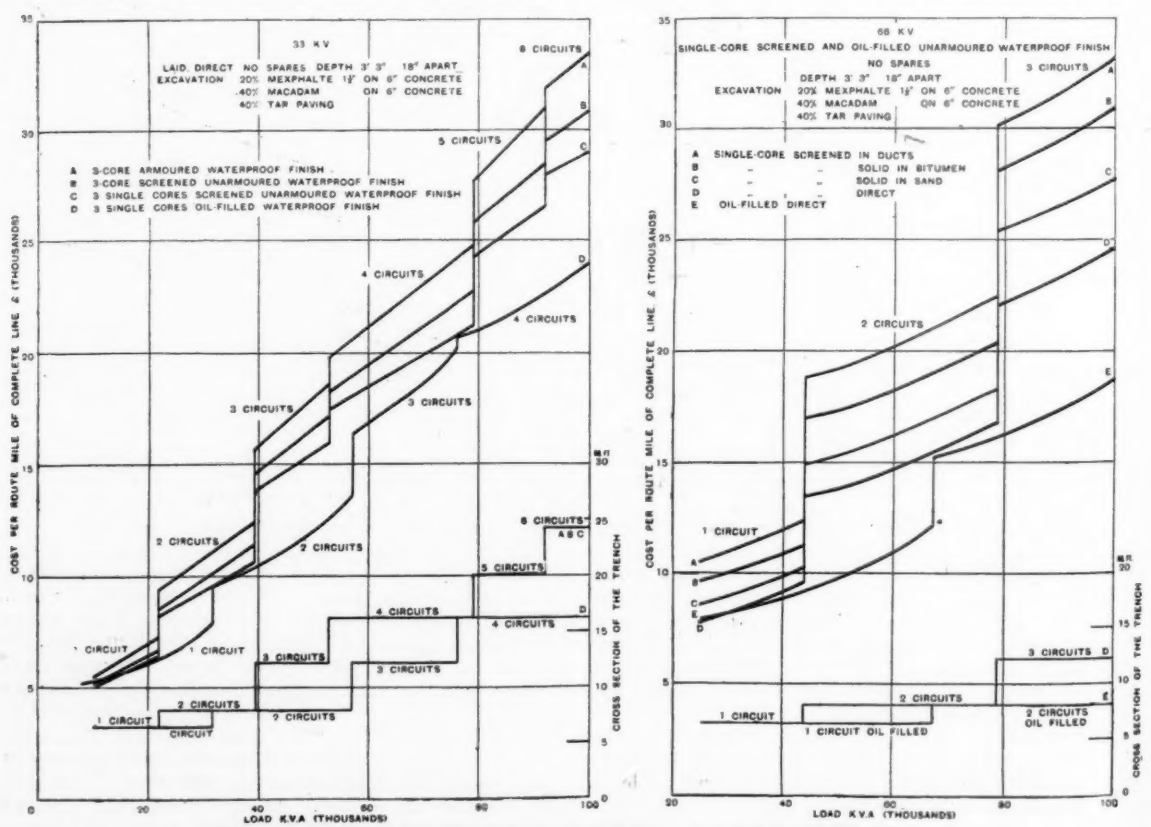
sheathed type); a 33-kV three-core screened-type cable, unarmoured; and a 33-kV line composed of three separate single-cores, unarmoured, all laid direct; from which it appears that the last mentioned is the cheapest method, the three single-core 33-kV cables being exactly in the same condition as any 66-kV single-core cables laid direct.

It may now be of some interest to consider how the new type of oil-filled cable lines compare with the lines which have been installed previous to its appearance. The oil-filled cable (fig. 4) has inside the conductor a longitudinal duct which is connected to special reservoirs, the capacity of which, owing to the design, can vary. The duct in the conductor and the reservoir are full of thin oil. The reservoirs receive the oil forced out during thermic expansion, due to load or temperature of the surroundings, and give it back to the cable during contraction. The conductor is insulated in the usual

Fig. 4.—Oil-filled Cable.

way, the only difference being that the thickness of insulation required for a certain working pressure can be considerably reduced. The ordinary lead sheath is applied over the insulated core, and is protected with impregnated cloth tape. The cable is then armoured with hard brass strip, which compensates for the lack of strength and elasticity of the lead. The brass armouring is protected and insulated by impregnated cloth tape and then a second lead sheath of ternary alloy is applied. As an overall finish, waterproof serving is used.

Owing to the provisions made for the lack of elasticity and strength of lead, and to give the compound suitable room for expansion, the working temperature of the oil-


33 K.V.
LAID DIRECT NO SPARES DEPTH 3' 3" 18" APART
EXCAVATION 20% MEXPHALTE 1½" ON 6" CONCRETE
40% MACADAM ON 6" CONCRETE
40% TAR PAVING
A 3-CORE ARMOURED WATERPROOF FINISH
B 3-CORE SCREENED UNARMOURED WATERPROOF FINISH
C 3 SINGLE CORES SCREENED UNARMOURED WATERPROOF FINISH
D 3 SINGLE CORES OIL-FILLED WATERPROOF FINISH
COST PER ROUTE MILE OF COMPLETE LINE, £ (THOUSANDS)
CROSS SECTION OF THE TRENCH
LOAD K.V.A (THOUSANDS)
66 K.V.
SINGLE-CORE SCREENED AND OIL-FILLED UNARMOURED WATERPROOF FINISH
NO SPARES
DEPTH 3' 3" 18" APART
EXCAVATION 20% MEXPHALTE 1½" ON 6" CONCRETE
40% MACADAM ON 6" CONCRETE
40% TAR PAVING
A SINGLE-CORE SCREENED IN DUCTS
B " " SOLID IN BITUMEN
C " " SOLID IN SAND
D " " DIRECT
E OIL-FILLED DIRECT
COST PER ROUTE MILE OF COMPLETE LINE, £ (THOUSANDS)
CROSS SECTION OF THE TRENCH
LOAD K.V.A (THOUSANDS)

Figs. 5 and 6.—Cost Comparison of Ordinary and Oil-filled Cables.

filled cable can be much higher than that of the ordinary cable, and as a consequence its load-carrying capacity is much greater. Thus, if oil-filled cable is used in place

of ordinary cable, the cost per mile and per kVA transmitted will be reduced; the cost of laying may also be reduced, owing to the smaller total copper section required and consequent reduction of the number of cables necessary. The oil-filled cable is actually an armoured cable, and is double lead-sheathed; it can therefore be laid direct in the ground and yet have a much larger coefficient of safety than the ordinary type of cable.

In special cases when it is essential that the cable be armoured with steel tape, or wire, a three-core oil-filled cable can be used for 33 kV or 66 kV working pressure. Three-core oil-filled lines have already been installed and are working satisfactorily at 33 kV and 66 kV in Italy and in the United States. Figs. 5 and 6 show a comparison between costs of complete lines of ordinary and oil-filled cables for 33 kV and 66 kV working pressures, and also the ground room required in each case.

The oil-filled type of cable, besides the economical consideration, has some advantages also over the ordinary type from the technical point of view. Defects in the lead sheath cannot cause trouble, because pinholes, porosity in the press mark, or similar defects, are detected during manufacture, owing to the high vacuum obtained in the cable at a high temperature (100 deg. C.). The cable is, in fact, given a preliminary drying operation in the usual manner; the first lead sheath is applied and the complete drying of the insulation then carried out. A very high vacuum can be built up and maintained in the cable itself, because of the small volume concerned and the high-grade laboratory vacuum pump used. As soon as electrical tests of insulation resistance, capacity, and power factor indicate that the cable is well dried, it is impregnated at 100 deg. C. with dried degasified oil, and left connected to a feeding tank while it is cooled to the ambient temperature with cold water. In this way it is possible to make practically perfect impregnation.

Faults in the lead which might occur after despatch, and damage during or after laying may result in leakage of oil, but this can be detected by inspection of the reservoirs, and by replacing the necessary amount of oil the cable can be kept in service until a convenient time is found for repair. Thus, continuity of service can be maintained.

There are no voids, or regions of low pressure, in an oil-filled cable. When there is a void in an ordinary cable, due either to faulty impregnation, or to expansion of the lead caused by variation of temperature, not only do electrical discharges take place across the void, but owing to the low pressure the dielectric strength of the insulation at that point is also considerably reduced. Oil-filled cable is completely free from these troubles because the impregnation is practically perfect and the minimum pressure of the oil is atmospheric.

There is a very high coefficient of safety in an oil-filled cable joint, as this does not undergo changes from high pressure to partial vacuum due to uncontrolled movements of the impregnating medium, but remains perfectly impregnated at all times.

Researches concerning the life-curves of both the ordinary type and the oil-filled type have clearly shown that such curves for the latter type are much flatter.

In vertical installations of normal-type cable, or where it is laid on a slope, it is difficult to avoid migration of the compound to lower points, thus creating dry areas at the high points and high hydraulic pressures at the low points; both conditions are likely to cause considerable trouble. The special devices which are sometimes installed at the joints to replace compound can only magnify the trouble eventually, although they may show some temporary improvement. Oil-filled cables are designed to work in the position in which they are installed, whether it be on a slope or level, and all the effects due to their position can be foreseen and provided for.

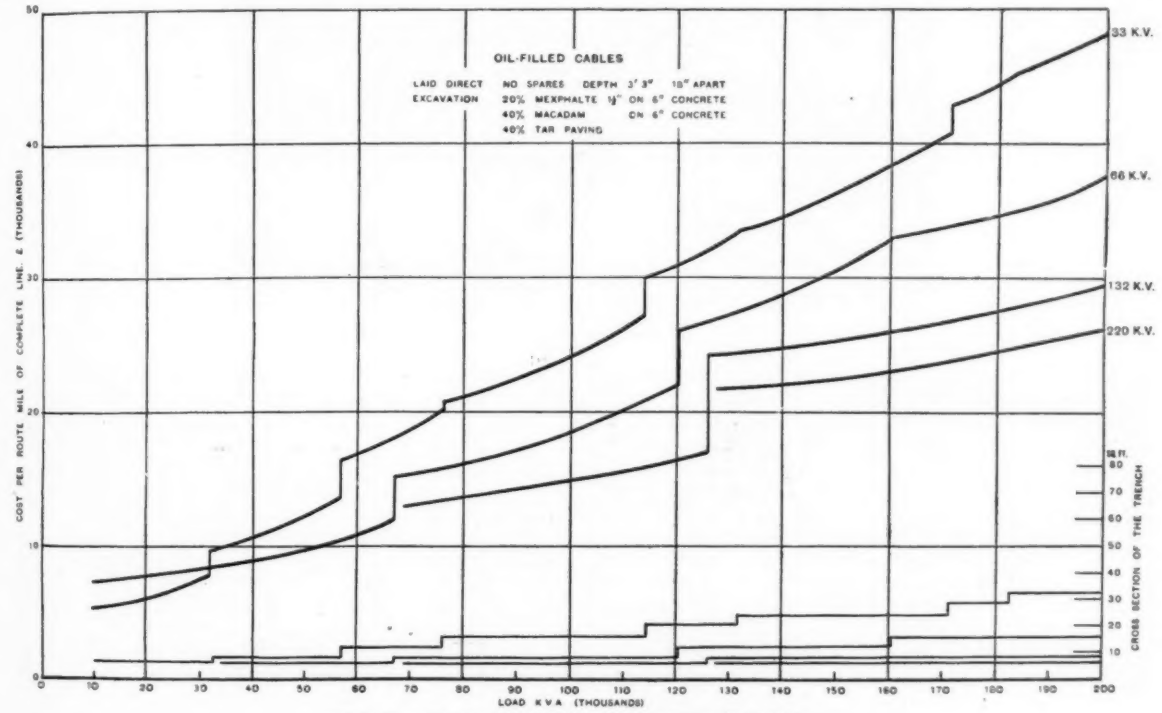

OIL-FILLED CABLES
LAID DIRECT NO SPARES DEPTH 3' 3" 18" APART
EXCAVATION 20% MEXPHALTE ½" ON 6" CONCRETE
40% MACADAM ON 6" CONCRETE
40% TAR PAVING
33 K.V.
66 K.V.
132 K.V.
220 K.V.
COST PER ROUTE MILE OF COMPLETE LINE. £ (THOUSANDS)
LOAD K.V.A. (THOUSANDS)
SQ.FT. CROSS SECTION OF THE TRENCH

Fig. 7.—Cost of Oil-filled Underground Cables.

Furthermore, the principle and the construction of the oil-filled type of cable makes it possible to install underground lines for working pressures up to 220 kV. Two important lines carrying 100 kVA each at 132 kV working pressure were installed two years ago, one in New York and one in Chicago, totalling approximately 50 miles of single-core cable, and have since been working without a single breakdown of any kind; also several shorter 132-kV lines have been working for years in Italy. Two 132-kV lines, totalling 52 miles of single-core cable, will be installed in London in the very near future and, although they are being treated as experimental, the makers have so much faith in their performance that they are taking the greater part of any risk which may exist. It is interesting to note that 220-kV lines are under consideration on the Continent.

Fig. 7 shows the cost of oil-filled underground transmission lines, laid, to carry up to 200,000 kVA at various working pressures from 33 kV up to 220 kV, and also the space required to accommodate the cables.

The Ocker Hill Power Station.

Brief notes on a twin-cylinder turbo-alternator set recently installed by the English Electric Co., Ltd.

SINCE the formation of the West Midlands Electricity District under an Order of the Electricity Commissioners in April, 1925, the Joint Authority established to administer it has been very active in co-ordinating and expanding the electricity supply facilities of the important areas in Staffordshire and Shropshire which comprise the district in question. Its generating stations include those at Wolverhampton, Walsall, West Bromwich, and Ocker Hill, while the programme is well advanced for erecting a new super-power station at Ironbridge, on the River Severn.

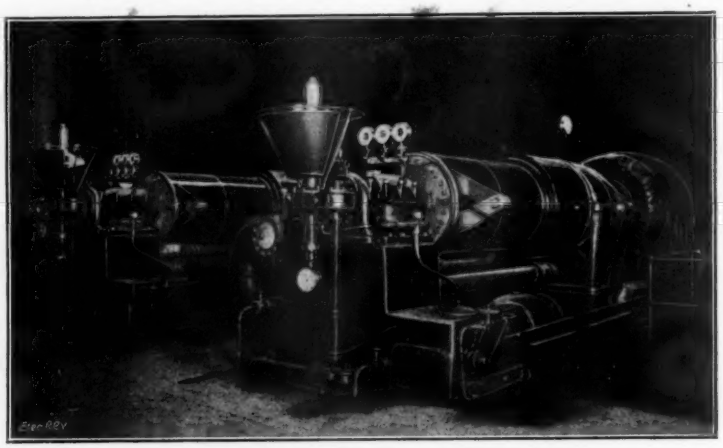


Fig. 1.—Two 1,500-kW Sets installed in 1906.

Towards the end of last year a new 10,000-kW two-cylinder steam turbo-alternator set was put into service at Ocker Hill, which, as our readers may remember, is the power station near Wednesbury formerly operated by the Midland Electric Corporation for Power Distribution, Ltd. The erection of the set and its condensing plant was completed by the manufacturers, the English Electric Co., Ltd., in ten weeks, and we understand that in 3½ months' running on day load (from 8 a.m to 5.30 p.m.) it has generated 6½ million kWh without needing any adjustments. The set runs at 3,000 r.p.m. and is one of the latest examples of the line of "English Electric" multi-cylinder machines which have been adopted in all

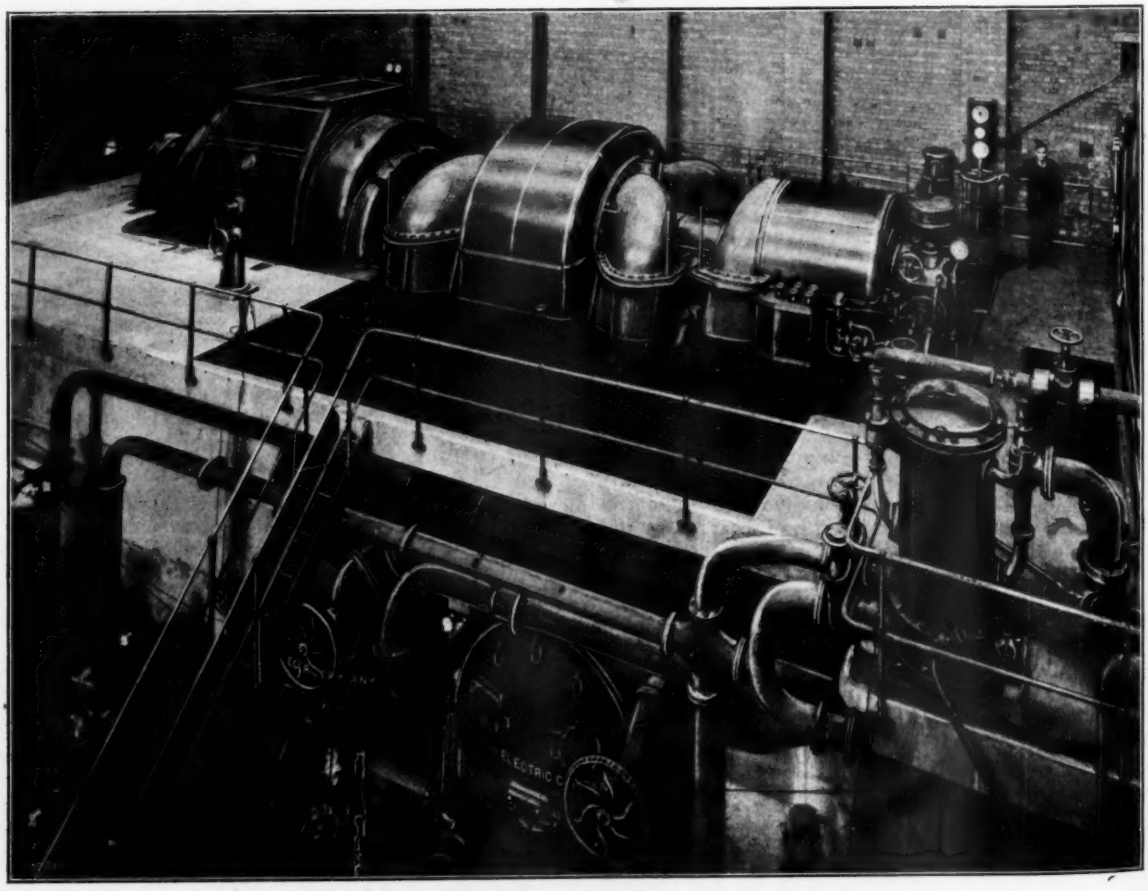


Fig. 2.—The New 10,000-kW Two-Cylinder Set and its Condensing Plant.

parts of the country. In interesting contrast to this modern plant, which is illustrated in fig. 2 on the previous page, are the two 1,500-kW reaction-type steam turbo-sets which were installed by the same Company in 1906 (fig. 1). After generating nearly 50 million kWh in the first six years these machines were still giving valuable service during peak loads last winter, 22 years after their installation.

The illustrations which we are able to reproduce of the sets referred to above provide a useful indication of the progress that has been made in the last 23 years in power-station practice.

A Large Transporter Crane.

Brief Details of an Electrically-driven Installation Recently Completed on the Continent.

AT the celluloid factory at Attisholz, Switzerland, there has just been completed a fine piece of engineering that was carried out by the Ateliers de Constructions Mécaniques, of Vevey, and by the courtesy of Mr. A. Dommer, of those works, and Mr. H. Demierre* we are able to reproduce photographs and give details of the installation.

The construction and erection of the transporter illustrated herewith gave rise to one or two difficulties which have been very neatly overcome. One of the problems had to do with the fact that, in order to avoid scaffolding and the raising to somewhere about 21 metres of a total weight of about 370 tons, the entire fabric was raised at one and the same time by means of two all-metal towers. A second difficulty which made the task rather tricky was that it had to be carried out in the open, and that resistance to wind pressure had to be calculated, not only for the vertical loads, but also for the oblique. The towers were placed by means of four hydraulic screw-jacks, worked by two electric pumps; and though the screw-jacks could move up to 22 cm., for prudence sake the lifting was carried out at the rate of only 18 cm. The stability of the towers, which were separated by a distance of 81.60 m., was guaranteed by shuttering lengthways and across, the latter bars being placed in position as the tower was raised. The cabin containing the machinery for the moving of the truck, weighing twenty-two tons and a half, was raised at the same time as the framework of the transporter.

Fig. 1.—Transporter Crane.

Special precautions had to be taken with respect to the weight to be carried, which was calculated to be 45 tons per girder, allowing for a wind-pressure of 150 km. per square metre. Rails of a weight of 57 kg. to the metre, duly riveted, are arranged along the whole length of 366 metres, with reinforced-concrete sealing, so as to reduce ground-pressure to 2 kg. per cm.², with expansion joints every twelve metres. The transporter, having to work over an area of 5½ acres and heap up wood to a height of five metres, runs at a speed

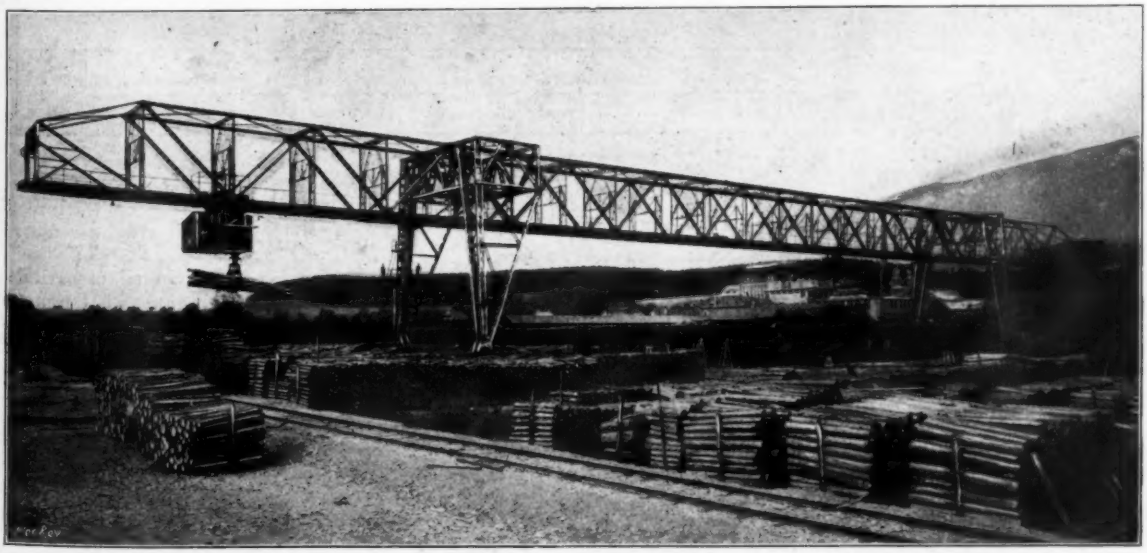


Fig. 2.—Recently Completed Electrically-operated Transporter at Vevey, Switzerland.

* Editor of the *Bulletin Technique de la Suisse Romande.*

of 20 metres a minute, being driven by an electric motor of 70 h.p.

The truck wheels and axle, a combination of a four-wheeled truck and a pivoting crane, slides on the transporter at a speed of 240 metres a minute, driven by means of a motor of 60 h.p., and the grab tackle, which is pincer-shaped, is operated by a motor of 34 h.p. This grab is moved vertically by means of a 50-h.p. motor at a speed of 58 metres per min., and the rotation motor of the crane is a 5-h.p. one.

The electricity used is three-phase, 500 volts, 50 periods, and is collected from a wire some 347 metres long that is supported on metal towers 6.56 metres above the level of the rails of the transporter. A vertical arm placed at the end carries the three trolley wires.

The permanent weight per metre is an average of 1,600 kg.

The weight of the moving crane is 25.5 tons.

The load of a crane is 5.5 tons.

The horizontal maximum effort in braking per beam is 5.20 tons per truck.

The shock is 26 tons per buffer.

The wind-force is 100 kg. per sq. metre for the crane when working, and 150 kg. per sq. metre when at rest.

The transporter, having been duly tested and approved, is now working at Attisholz.

Electrically-heated Hotbeds.

The electrical heating of hotbeds, which was brought about in Sweden by the shortage of stable manure, is claimed to have advantages over the older method.

By DR. ALFRED EKSTRÖM, M.I.E.E.

THE use of electricity for heating hot-beds has raised much interest in Sweden during the last two years. Its initiation can be traced to Norway, where it was noticed that in parts of a field where underground cables transmitting electricity were laid in springtime the snow melted sooner and vegetation began earlier than in other parts, due to the soil absorbing warmth from the cables transmitting the electric power.

A Norwegian engineer, Georg Jacobsen, took advantage of this fact and constructed hot-beds of which the soil was heated by means of resistance wires laid in the beds, the wires being heated by very low-voltage electric power.

In Sweden the idea was developed by a merchant-gardener in the neighbourhood of Stockholm, Mr. Edgar Eriksson, in co-operation with Mr. Harald Edholm, engineer of the Royal Water Power Board. For this purpose special cables were constructed, consisting of a resistance wire insulated with asbestos and paper-impregnated cotton ribbons, surrounded by an airtight lead covering. The cable is then covered with a composition to prevent damage from acid in the soil and stray direct currents. The latter are very disastrous for the lead cover, if it is not very carefully protected.

Lately a construction without a lead cover has proved to have certain advantages, being at the same time considerably cheaper.

The electric power used for this purpose is at a pressure of 127 or 220 volts. The resistance wire of the cable is connected to the phase-wire, while the lead cover is connected to the grounded wire, the resistance-wire and lead covering being in this case soldered together at the far end of the cable.

The result of the experiments is that at present several hundred gardeners are using electric hot-beds with a total area of about 25,000 sq. yards and a total load of about 3,000 kilowatts all over Sweden.

Economic Considerations.

The real reason for the application of electricity for heating hot-beds was the lack of stable manure, on account of the greatly increasing use of the motor-car, as well as the withdrawal of the cavalry regiments, which has brought about a great difficulty for the gardeners in the neighbourhood of the larger towns. Electrically-heated hot-beds have, however, proved to offer new advantages for the industry.

The method of manuring hot-beds, as is well known, is to heat the soil in the springtime, and this is effected by the process of fermentation in stable manure; the manure burns, so to speak, and after four to six weeks is burnt out. During this time the temperature of the surrounding atmosphere is supposed gradually to increase and to take over the transmission of the necessary warmth to the hot-beds. In the case of bad weather conditions it may happen that if the stable manure is burnt out before the necessary increase in the atmospheric temperature has come about, the growing vegetation in the hot-beds will be damaged.

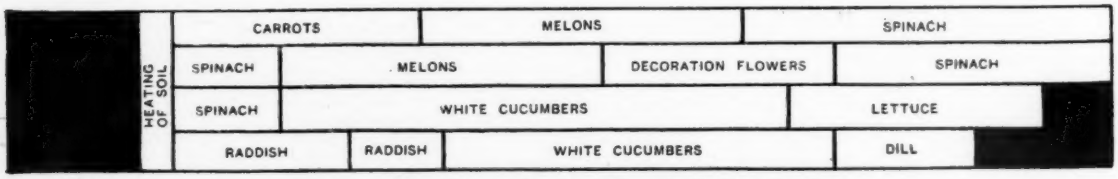


Fig. 1.—Cultivation Plan for Electrically-heated Hotbeds.

In the autumn, when the atmospheric temperature is gradually decreasing, artificial heating by the use of stable manure is generally not possible.

The electrically-heated hot-bed is in all cases independent of the season of the year, and of the more or less uncertain weather conditions. The transmission of the necessary heat can always be controlled exactly—"a tropical heat" of the soil and its vegetation can readily be attained, thus affording gardeners new possibilities for the development of their cultivation. Moreover, the time of vegetation can be correspondingly increased.

The electrically-heated hot-bed has also other advantages. The stable manure hot-bed must, as soon as the manure is burnt out and the vegetation is ready for use, be renewed completely, and can thus be used for only one occasion. An electrically-heated hot-bed, on the other hand, can be used without renewal for continuous lots of cultivations—one after the other—not only during one season, but so long as the necessary store of nourishment in the soil is available, which will

generally continue for two or three years. This fact can be utilised during one season of vegetation in the following ways :—

1. Early cultivation can be undertaken, such as the very early table vegetables, spinach, lettuce, radishes, carrots, &c.
2. Cucumbers and melons.
3. Lastly, during the late summer, again table vegetables.

The cultivation of table vegetables during the last period of summer is arranged in such a way that they are ready for use just at the end of the

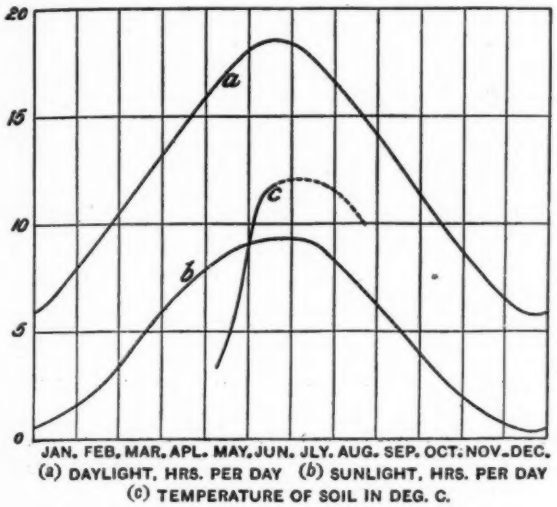


Fig. 2.—Vegetation Data for Stockholm Area.

vegetation period and kept in that state by a supply of only so much heat as will prevent the hot-beds from being frozen up to the first month of the winter, when they are taken out and sold.

Fig. 1 shows such a plan of cultivation for a large set of hot-beds which is in continuous use from February to the end of the year. The plan consists of three parts—early table vegetables are cultivated; then cucumbers and melons, partly also flowers for decoration; lastly, table vegetables for keeping and selling in the winter months.

Experience has shown that in the middle of Sweden the vegetation period for horticulture, on an average, will hold not more than about eight months—from the end of February to the end of October. No doubt this is a result of the length of the day, the hours of daily sunshine, as well as of the temperature of the soil. Fig. 2 shows the average figures for the surroundings of Stockholm.

From this figure it can be seen that in that climate vegetation necessitates a minimum sunshine of four hours per day and daylight for about ten hours per day. From the figure, however, it will be observed that in the months of April and May sunshine and daylight increase so much that vegetation is mainly kept down by the low temperature of the soil. By the utilisation of artificial heating of the soil there might thus be obtained a vegetation of similar efficiency during a certain period before June 21st as is now obtained during a similar period after that date. Many series of experiments by the Royal Acadamy of Agriculture is Sweden have confirmed this supposition.

During the period from end of October until the end of February it will not be possible to cultivate vegetables that require light. Several experiments have been made to substitute artificial electric light for sunlight, but no real economic results have until now been attained in that respect.

Fears have been expressed that the electrically-heated hot-beds would not give as good results as the stable-manure hot-beds, owing to the lack of carbonic acid gas (CO); this has, however, been proved not to be the case.

How to Lay Down an Electrically-heated Hot-bed.

The soil to be used for an electrically-heated hot-bed must be well drained and the hot-bed built up on a foundation of slag. It is necessary that this foundation should consist of a good insulating material, so as to prevent the heat being transmitted down into the earth. If possible, it is advisable to use above the slag a layer of charcoal residue, which is a good insulator of heat, and will in the end also give off carbonic acid gas.

On this foundation the hot-bed is then arranged. The electric-resistance cables are placed at distances from each other of about 7 in. in tubes of brick, fig. 5; above these a thin layer of sand is put down, the sand being a good conductor of heat. Then the garden soil is put down to form a layer of 5 to 10 inches. For ventilating the soil it will be suitable to arrange vertical tubes of brick above each row of the horizontally-laid tubes protecting the cable. One vertical tube is then arranged every tenth yard between two adjoining horizontal tubes. Inside the walls of the hot-beds above the soil there is also placed a resistance cable for heating the air in the hot-bed (fig. 3). (A standard frame was illustrated in ELEC. REV. of August 10th, 1928, p. 230.)

The glass frames covering the hot-beds must be made to fit tightly, and the soil round the beds should also be heat-insulated. At night the windows of the hot-beds should be covered, as usual, with mats of weeds or a similar material.

The Consumption of Electrical Energy.

In order to obtain an increase of temperature in the soil of about 75 deg. F., it is necessary to use in the middle of Sweden in the spring about 1.1 kWh per sq. yard during 24 hours. It might, however, be suitable to calculate with 1.4 to 1.5 kWh. This energy being generally utilised only during the 12 hours of the night, the result is a maximum demand of about 120 W per sq. yard. The supply of night energy is naturally of great advantage to the electricity works. It has, however, been proved that it is also advantageous to the hot-beds. By supplying heat to the hot-beds during the night, they will be warm early in the morning when the daylight is most efficient. During the day the sunshine will take over the necessary transmission of warmth. The light rays of warmth pass, as is well known, quite easily through the glass windows, which is not the case with the dark rays of warmth. Thus, the bed will keep its need of warmth provided for during the day.

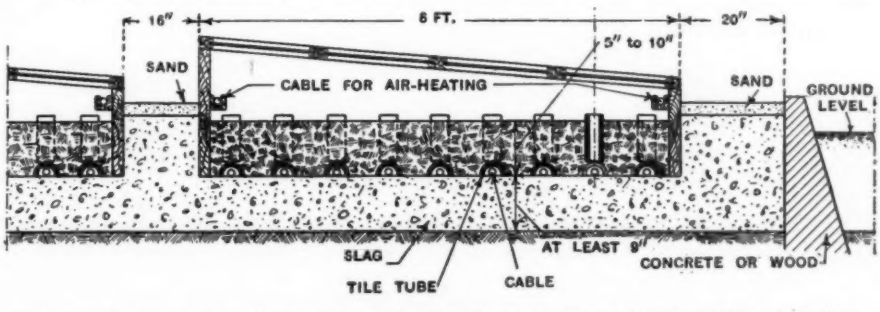


Fig. 3.—Construction of Electrically-heated Hotbed, showing Disposition of Cables.

A special heating and switching arrangement for the supply and regulation of the necessaryy electrical energy is constructed by the Sieverts Cable Works, of Stockholm. Fig. 4—given by Engineer Edholm—shows the need of energy during one period of vegetation for

a large set of hot-beds for cultivation according to fig. 1. In this case a small amount of energy is used day and night, the peak (from February until July) only being reached at night.

Economy of the Electric Hot-bed.

The price of the necessary electrical energy is obviously of great importance for the economic use of electrically-heated hot-beds. In the neighbourhood of Stockholm, where the price of stable manure, when available, is about 5s. to 7s. per cu. yard, it has proved economical to pay a price of about 1d. per kWh for effectively managed hot-beds.

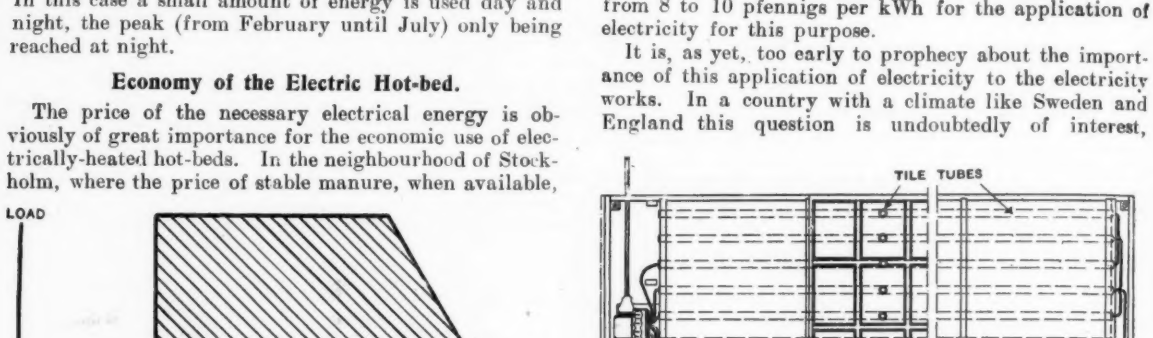


Fig. 4.—Energy Requirements of Large Electrically-heated Hotbed.

The same results have also been obtained in the north of Germany; in the publication of the Association of the German Electricity Works ("Elektrizitätswirtschaft"), Director Petri, at the Central Overland. Pommern, has recently stated the maximum price to be from 8 to 10 pfennigs per kWh for the application of electricity for this purpose.

It is, as yet, too early to prophecy about the importance of this application of electricity to the electricity works. In a country with a climate like Sweden and England this question is undoubtedly of interest, especially to the gardeners in the neighbourhood of larger towns. But even by private people living in the suburbs in houses with a little land attached—used for horticulture on a small scale—electrically-heated hotbeds are beginning to be used. At all events this is a question the development of which the electricity works ought to follow up with attention.

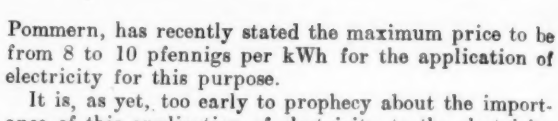


Fig. 5.—Disposition of Cables and Tubes.

The Royal Society's Soirée.

Annual Exhibition and Demonstrations.

THE annual conversazione arranged by the president, Sir Ernest Rutherford, O.M., and Council of the Royal Society took place on May 15th at Burlington House, Piccadilly.

Some 38 exhibitors, 12 more than last year, provided the customary display of specimens and apparatus for the inspection of Fellows and guests.

Though not of an electrical nature, Dr. R. G. Canti's kinematograph demonstration of the movements and growth of living tissue cultivated *in vitro* was a striking illustration of the value of kinematography to the scientist.

Extremely interesting also was the exhibit of Mr. Bryan Matthews, which indicated the use of a moving-iron oscillograph for recording sensory nerve action currents. The instrument has been developed to record the transient change of potential which occurs at the surface of a nerve trunk when a nervous message passes in it. A trunk may contain 10,000 individual fibres; when any one of them transmits an impulse a potential change of some 20 microvolts occurs and lasts about 2/1,000 second. In order to record the electrical changes accurately a very rapid and sensitive recording system is necessary. The potentials are led off from the nerve with non-polarisable electrodes, and are applied to the grid of a valve amplifier and amplified by four resistance-capacity coupled valves. The amplified potentials are applied to the grids of four five-electrode valves which drive the oscillograph. The moving system has a natural frequency of vibration of 6,000 per second, and in this way accurate records are obtained of potentials of a few microvolts of one or two milliseconds duration, and an exact physical record can be made of the impulses which constitute a sensation on their way to the brain.

The Research Department, Woolwich, loaned pictures of progressively rolled "Armco" an annealed iron obtained in three directions, normal, parallel and transverse; they show that orientation appears much sooner in the transverse direction than in the others, and persists in the same direction after annealing.

Amongst other items, Messrs. Adam Hilger, Ltd., showed Dr. Jean Thibaud's X-ray grating spectrograph which is intended for the study of the soft X-rays and of the extreme ultra-violet. Its principal feature is the use of a ruled grating at very nearly grazing incidence, in which position the effective spacing of the grating is sufficiently small to disperse a beam of soft X-rays and at the same time, owing to the refractive index for such radiations being less than unity, total reflection takes place at the grating surface. To avoid absorption of the radiations the entire spectrograph is exhausted by a Holweck, or other suitable high-vacuum pump. The discharge tube, or X-ray tube, can be mounted alternatively on the spectrograph; the latter is of a specially designed hot-cathode type.

The Department of Scientific and Industrial Research, radio research station, Slough, had an instantaneous visual direct-reading radiogoniometer on view. This cathode-ray direction-finder gives a direct visible read-

ing of the azimuth of a wireless transmitter relative to the receiving station. The direction of arrival of the wave-train is read on a compass dial drawn on the screen of a low-voltage cathode-ray oscillograph, the indication being a line of fluorescence on the screen. The indication is instantaneous; thus, for example, the direction of arrival of a single atmospheric lasting for a thousandth of a second, or less, can be read with an accuracy within one degree. The directions of two, or more, transmitting stations working simultaneously on the same wave-length can be determined. Charts showing the distribution of sources of individual atmospherics, located by two such instruments at the ends of a base 500 km. long, were exhibited.

The Cavendish Laboratory, Cambridge, showed a cæsium tube (Mr. N. A. de Bruyne) which contained a tungsten filament and a collecting plate in cæsium vapour at a pressure of 10^{-6} mm. It can be used to demonstrate the existence of Knudsen's "critical temperature" above which condensation of atoms on a surface cannot take place. By applying a positive voltage to the plate the enormous effect of a monatomic layer on the thermionic emission can also be shown; when the filament current is switched off the emission actually rises, due to the deposition of cæsium.

The National Physical Laboratory indicated methods of measuring the thickness of films between surfaces in close (wringing) contact (Mr. F. H. Rolt and Mr. H. Barrell). The apparatus exhibited was that used by Rolt and Barrell in the experiments on wringing films described in the Royal Society's *Proceedings*, A, Vol. 116, p. 401, 1927.

The Cambridge Instrument Company's portable electrocardiograph makes use of a galvanometer of the Einthoven type, but which is more compact and lighter than the standard instrument, and as it is ironclad throughout there is little external magnetic leakage (see Elec. Rev., January 18th, 1929, p. 122).

Professor G. P. Thomson's diffraction of electron waves photographs are the result of a beam of cathode rays (electrons) passing through a very thin film of metal. Rings are caused by the regularities of the metallic crystals acting like a diffraction grating on the waves which guide, and perhaps partly compose, the electrons. The metal films used are of the order of one-millionth of a cm. thick; they are transparent to ordinary light.

The Anglo-Persian Oil Co. exhibited apparatus for the visual examination of oils while being "cracked" under pressure. The oil is contained in a transparent silica tube which is in communication with a steel cylinder containing mercury, so that any pressure up to 1,000 lb. per sq. in. can be maintained on the oil. The silica tube is inserted into an electrically-heated air oven fitted with glass windows and working at temperatures up to 500 deg. C. The oil can be "cracked" to any desired extent by introducing the silica tube into the oven for a limited time during which the phase relations can be observed. The oil can be agitated during the experiment by means of a magnetic stirrer.

Sir Robert Hadfield, Bt., F.R.S., exhibited specimens illustrating the properties of ferrous alloys and also special metallurgical and other processes. For example, "Era" heat-resisting steel and its application to the Berthelot calorimeter bomb. Specimens of steam-turbine blading prepared from forged and rolled sections of "Hecla/A.T.V." non-corrodible steel; there are now in use turbines aggregating over one million horse power equipped with this material. A new and improved tool steel, possessing extraordinarily high cutting qualities, which is a combination of iron with no less than eight other elements, and is even capable of machining the hard material known as manganese steel. Photomicrographs of very high magnification, up to 8,000 diameters, of various types of steel. Photograph of the new type of high-frequency furnace working at 500 cycles, now in regular use at the East Hecla Works, Sheffield, with specimens of the steel castings produced therefrom. Photographs of a new large capacity British-made crusher, which has an output of over 200 tons of crushed material per hour, and also of a block of hard North Wales granite weighing $2\frac{1}{4}$ tons, and the large number of fragments into which it was crushed in the short space of 55 seconds, with an exerted energy of 175 h.p.

An interesting collection of photographs of eminent scientific men taken by Mr. A. A. Campbell Swinton between the years 1877 (wet-plate process) and 1912 was on view.

The Davy Centenary.

The Peerless Scientist's Contributions to Electro-chemistry.

By T. B. F.

WHEN Sir Humphry Davy, the inventor of the safety lamp, was at the height of his fame, Cuvier, the anatomist, declared that he "occupied in the opinion of all that could judge of such labours the first rank among the chemists of this, or of any other, age."

There have been few, if any, parallels to the brilliant achievements of the narrow-chested and undergrown Cornish boy who, in the brief space of thirty years or so, raised himself from obscurity to a position of acknowledged supremacy in the scientific world, and his centenary on May 29th claims the special attention of electrical scientists by virtue of the part which Voltaic electricity played in his researches.

Davy, the son of a wood carver, born at Penzance on December 17th, 1778, up to his nineteenth year had never seen a chemical operation performed, but with an unconquerable thirst for fame; Lavoisier's *Elements* as a text book; phials, wine glasses, tea-cups, tobacco pipes and an odd earthen crucible as his paraphernalia; and the common mineral acids, the alkalis, and a few drugs from the surgery as his stock of chemicals, he set out to conquer.

Three years later he was well on the high road to success, being appointed lecturer to the Royal Institution of London. Before leaving Bristol, where he had discovered "laughing gas," he contributed a number of short papers on what was then termed "Galvanic Electricity" to *Nicholson's Journal*. He succeeded in establishing the intimate connection between the electrical effects and the chemical changes going on in the pile, and drawing definite conclusions concerning their mutual dependence. But the distractions of his duties at the Royal Institution, which made large demands upon his time, temporarily prevented him from pursuing his researches in this direction, and it was not until Volta's capital discovery of the Voltaic Pile had imparted a new impulse to the

study of Voltaic electricity, its effect and applications, on the part of English men of science, that he found the opportunity to turn again to the subject.

As he himself said, " the Voltaic battery was an alarm bell to experimenters in every part of Europe; and it served no less for demonstrating new properties in electricity, and for establishing the laws of this science, than as an instrument of discovery in other branches of knowledge; exhibiting relations between subjects before apparently without connection, and serving as a bond of unity between chemical and physical philosophy." Davy seems to have been particularly impressed by the power of the Voltaic Pile as an analytic agent; and the Laboratory journals preserved at the Royal Institution contain numerous references to his trials of the behaviour of compound substances under its influence. Dr. Thorpe points out very truly that it was actually in this intermittent way, by the utilisation of odd chances now and then, that " Davy gradually succeeded in unravelling the fundamental laws of electro-chmeistry, and in thus importing a new order of conceptions, altogether unlooked for and undreamt of, into science."

A Memorable Paper.

The conclusions arrived at by Davy were embodied in a paper " On Some Chemical Agencies of Electricity " submitted to the Royal Society and made the Bakerian lecture of the year. There was no scientist of the day at all comparable with Davy for his natural eloquence, his chemical knowledge, his happy illustrations, his well conducted experiments and his clearness and lucidity of style, and we are told that the publication of that paper, which reflected all his distinctive qualities, created a profound sensation, both at home and abroad. Long afterwards Berzelius characterised it as one of the most remarkable memoirs that had ever enriched the theory of chemistry. What was more important at the time, however, was the action of the French Institute.

Bonaparte, with a view of stimulating investigation, had instituted a medal " for the best experiment which should be made in the course of each year on the galvanic fluid," and had further intimated his desire to give the sum of sixty thousand francs " à celui qui, par ses expériences et ses découveries fera à faire a l'electricité et au galvanisme un pas comparable à celui qu'ont fait faire à ces sciences Franklin et Volta." A committee of the Institute, consisting of Laplace, Halle, Coulomb, Hauy and Biot, awarded the medal to Davy, a tribute which was rendered all the more noteworthy by the fact that at the time France and England were at war, and intense and bitter feelings prevailed on both sides of the Channel.

In the experiments which led him to the discovery of the new metals, potassium, sodium, barium, strontium, calcium, and magnesium, Davy made constant use of the Voltaic battery.

" A Troublesome Person in Chemistry."

In November, 1807, in another Bakerian lecture which carried him to the pinnacle of his fame, he dealt specifically with " some new phenomena of chemical changes produced by electricity, particularly the decomposition of the fixed alkalies; and the exhibition of the new substances which constitute their bases; and on the general nature of alkaline bodies."

His discoveries were all made and perfected with marvellous speed, and at times he worked under the stress of great mental excitement. His cousin, Edmund Davy, who acted as his assistant during the period in which he was engaged in decomposing and recomposing the fixed alkalies, used to say that when he saw the minute globules of the quicksilver-like metal burst through the crust of potash and take fire his delight knew no bounds; he danced about the room in ecstasy, and it was some time before he was sufficiently composed to continue his experiments.

No one had imagined that potash and soda contained metals, and the sentiments of the Aberdonian professor who is said to have irritably remarked that this " ane Davy was a vera troublesome person in chemistry " only mildly reflected the astonishment of the whole body of scientists whose convictions had been so rudely disturbed by the young and self-taught scientist.

In a lecture at the Royal Institution, delivered at the request of the managers, while Davy was prostrated by illness, Dr. Dibdin pronounced the verdict that Davy's investigations:—" May justly be placed amongst the most brilliant and valuable discoveries which have ever been made in chemistry, for a great chasm in the chemical system has been filled up; a blaze of light has been diffused over that part which before was utterly dark; and new views have been opened so numerous and interesting that the more any man who is versed in chemistry reflects on them, the more he finds to admire and to heighten his expectations of future important results. Mr. Davy's name, in consequence of these discoveries, will be always recorded in the annals of science amongst those of the most illustrous philosophers of his time. His country with reason will be proud of him."

Meeting with Volta.

Hungry as he was for scientific fame, with a hunger that was unappeasable, Davy on his recovery lost no time in returning to his laboratory. The results of his renewed activities were embodied in his fourth Bakerian lecture " On some new electro-chemical researches on various objects, particularly the metallic bodies, from the alkalies and earths and on some combinations of hydrogene." It was through his inquiries in this particular domain that Davy was led to the discovery of telluretted hydrogen. Impulsive in his methods, his phenomenally active mind was not content with ordered ideas of approach to any subject. Often he had half a dozen experiments proceeding simultaneously on disconnected parts of the same inquiry.

After discovering the two chlorides of phosphorus, Davy experimented in the electrisation of pure liquid fluoric acid, as well as conducting inconclusive investigations with nitrogen chloride, one of the most powerful explosives known to chemists. Whatever subject he touched he invested with something new which passed immediately into the currency of accepted scientific doctrine.

In 1814 he saw Volta at Milan, but confessed himself disappointed by his conversation, which was not brilliant; but the disappointment seems to have been mutual. Davy, it is related, had written to announce his intended visit, and on the appointed day and hour Volta, in full dress, awaited his arrival. " On the entrance of the great English philosopher into the apartment, not only in *déshabille*, but in a dress of which an English artisan would have been ashamed, Volta started back in astonishment, and such was the effect of his surprise that he was for some time unable to address him."

Honours were showered upon Davy. He was first knighted and then created a baronet, elected president of the Royal Society, and for his invention of the safety lamp was presented with a public testimonial. He died at Geneva on May 29th, 1929, at the early age of 52. A statue in his native town of Penzance, and a tablet in Westminster Abbey bear tribute to his genius, but as a writer in " Silliman's American Journal of Science and Arts " happily expressed it " his reputation is too intimately associated with the eternal laws of nature to suffer decay; and the name of Davy, like those of Archimedes, Galileo, and Newton, which grow greener by time, will descend to the latest posterity."

Electricity and the Tides.

Notification has been received by Mr. E. L. Fleming, secretary of the Exe Power Experiment Association, that the Board of Trade will grant the Association permission to moor two pontoons in the Exe estuary for the purpose of ascertaining what power can be obtained from the tidal waters in connection with the scheme for harnessing the Exe for electrical purposes.

Possibilities in Palestine.

The author shows that many kinds of activity are being stimulated by the spread of electricity supply in the Holy Land, and urges British manufacturers to take advantage of the opportunities which offer.

By C. H. DOBELL, A.M.I.Mech.E.

AN article on the development of Palestine can be very conveniently divided into three parts, the electrical development, the advancement of other trades, and the benefits to be derived by the home manufacturers, and since it is evident that the last two are dependent upon and will progress in proportion to the first we will deal with them in that order.

In 1921, two Concessions were granted to Mr. Pinhas Rutenberg for the supply of electricity to the whole country (excluding Jerusalem and district within a radius of 20 km. from the Church of the Holy Sepulchre, in the centre of the old city), one to utilise the waters of the river Auja, which runs into the Mediterranean Sea near Jaffa, and the second to utilise the waters of the rivers Jordan and Yarmak, which, combined, run into the Dead Sea.

The first is operated by the Jaffa Electric Co., which has abandoned the idea of using the fall in the Auja, since the power to be obtained there was only 500 h.p. and quite inadequate to meet the demands of Jaffa and district, and has erected a fuel station at Tel Aviv, consisting of two 500-h.p. Deutz engines driving 6,600-V A.E.G. alternators, distributing by underground cables to transformer stations and supplying the l.p. networks at 380/220 V 3-phase. The supply was brought into service in 1923; the demand rose very rapidly and with the construction of the first overhead transmission line, 14 km. in length, to Sarafand to supply light and power to the Air Ministry's cantonments and workshops, which was brought into service in November, 1924, it was necessary to increase the capacity of the station and to that end an additional unit of 250 h.p. by Mirrlees, Bickerton & Day was installed. Following further extensions of the service in Jaffa to residential quarters and the conversion of factory drives to electricity, plus the springing up of new industries, a second set of the same power by the same makers was laid down. Overhead extensions followed to Rishon Le Zion, Petach Tikvah, and Nes Ziona, all flourishing colonies, mostly interested in the cultivation of vines and oranges and the vintage of wines. Pole transformers were installed where necessary to supply electricity for pumping and lighting to the groves and vineyards *en route*.

In the meantime, activities were commenced by the Palestine Electric Corporation, which had taken over the second or Jordan concession, in Haifa, where a fuel station was erected, comprising in the first place, three 250-h.p. sets of Metropolitan-Vickers alternators and Mirrlees, Bickerton & Day engines (since increased to four). This station was opened in June, 1925, some six or eight months after the commencement of the work. In Tiberias the Corporation put up a 150-h.p. station, primarily for the supply of electricity to the new pumping station on Lake Tiberias for the town's water supply. On completion of the Jordan works (which were described in our issue of May 3rd, p. 773) all these fuel stations will act purely as reserve stations, and the whole normal supply will be taken from the hydro-electric works. The present supply in Haifa is on the same system as in Jaffa, but the station at Tiberias produces at low pressure and supplies the network direct.

A third concession, for Jerusalem and district, which was granted to M. Mavromatis, has been recently taken over by Messrs. Balfour, Beatty & Co., who are now constructing a power station at Jerusalem.

The Jaffa Electric Co. experienced such a demand, that in 1926, three years only after its inauguration, further extensions had to be put in hand and the addition of a 1,125-h.p. Fraser & Chalmers set driving a G.E.C. alternator was made, while the power house was enlarged sufficiently to accommodate two more such sets if the necessity arose.

Thus has the seed been sown towards the growth of an all-electric country and great credit is due to Mr. Rutenberg and all those working with and under him for the speed with which the advance has been made. Side by side with this advance, other trades and commercial concerns have grown up, attempting to obtain by gradual development every ounce of wealth which the country will yield.

The hope of the country is in its agriculture, and as electricity has been brought within reach of the countryside, new orange groves have been planted, more land brought under cultivation, water supply made easier and the colonists' homes made cleaner and more comfortable. Thus we may safely expect that all agricultural machinery will one day be entirely electrically driven. The needs of the country have been enumerated in a previous article, and in looking back over experiences there, one realises the amount of work to be done and the enormous possibilities dependent upon and arising from a cheap and efficient electricity supply.

The electrification of the Government-owned Palestine Railways from Haifa to Kantara on the Suez Canal, with branch lines to Jaffa, Jerusalem and towards Damascus (the last named passing the Jordan works), and the construction and electrification of a railway from Bagdad to Palestine are possibilities of the future.

The enormous benefit to the Port of Jaffa in the handling of goods by electric lifts and cranes, and the replacing of the present petrol locomotives on the decauville railway from the Custom House to the railway station by electric trucks will be apparent to all. The use of electricity, in the construction of Haifa Harbour, in the transport of the mineral wealth of the Dead Sea to the coast, and in pumping stations for the supply of water to the towns, will render the works easier and more rapid in each case.

In both Haifa and Jaffa the growth of factories has been encouraged by the installation of electricity, and among present and future loads will be found the pumping of water for irrigation on agricultural and fruit-farming lands, the motive power for agricultural machinery, rock drilling and pneumatic machinery, stone crushers, small and large engineering and carpenter's shops, the lighting of places of worship and of entertainment, and of otherwise badly lit streets, the handling of goods, heating and, after a time, cooking in the better class houses and hotels. The possibility of exporting electricity must not be overlooked since it is almost certain that there will be an ever increasing demand in the countries bordering on Palestine.

It is to be hoped that the regulations governing the supply of electricity will not be too strict, since it is impossible to open up a country if there are too many hampering rules and regulations. It is better by far to let them evolve themselves; for example, the difficulties of running overhead lines in any Eastern bazaar under rules that apply to highly-civilised provincial towns will be appreciated by all, yet the electrical companies have

had to overcome such difficulties and are prepared to supply the humblest dwelling in the meanest *souk*.

Having reviewed the possibilities, let us now inquire to what extent the manufacturer at home is going to benefit. It is a matter entirely in his hands whether he will be wise and go out himself or send a representative of authority to study the situation on the spot, or leave it alone. If he decides on the first, he will find the business to be obtained worthy of a very determined effort, he will find men on the spot well able and willing to represent him, and if he makes up his mind to make a great display of his goods, to assist in the education of the people in the use of his products and to give generous terms to those who are willing to trade with him, the great bulk of the trade will drift into his hands, for commerce in Palestine will grow in proportion to the extension of supplies of electricity. Electricity will be brought into the service of the farmer and the manufacturer, it will be brought into the service of the transporter and the carrier and will finally load the produce of the country on board ships, speeding up the work of each and enabling this prospective all-electric country to take pride of place among the countries administered by us. Are we at home going to allow this future market to fall into the hands of foreign competitors when our position there was gained at the expense of British lives and money, or are we going to take the necessary steps to seize the prize before the foreigner does so?

Electricity in Schools.

Report of a Conference convened by the Electrical Association for Women.

An informal conference on "Electricity in the Schools," convened by the Electrical Association for Women, was held on May 8th. Mrs. S. E. Hammer (chairman, E.A.W. Council) took the chair, and welcomed the representatives of the various organisations present. The idea of calling the Conference, she said, was to have a frank discussion between representatives of the electrical industry and educational organisations with regard to the desirability of introducing some teaching on matters electrical into girls' schools, and also to discuss the question of suitable training for girls who wish to enter the electrical industry.

Miss C. Haslett, director, E.A.W., stated that the Association was constantly receiving requests from headmistresses for a syllabus of simple instruction on matters electrical suitable for girls' schools; also considerable interest had been shown in the subject by domestic science teachers and other representative educational folk. As a result of these various negotiations the E.A.W. felt that the time had arrived when some co-ordinated effort should be made in connection with that important matter. The Association was making a survey of the kind of domestic electrical apparatus which existed in girls' schools and domestic science centres; with the exception of a few progressive centres the equipment, if it existed at all, was often out of date. There was an increasing demand for women to act as demonstrators and saleswomen in the electrical industry, and an indication that other posts would become available in time.

Miss H. Shaw, B.Sc. (member, E.A.W. Council) said that most of the domestic science training colleges were trying to work somewhere in their syllabuses a certain amount of training in electrical work. Those who needed help were those already out in secondary and elementary schools; the teachers were only too anxious to use electricity. The objection raised by the teachers in the elementary schools was that the children were not using electricity in their own homes and, therefore, did not need electrical knowledge; it was better to teach them about the apparatus they had already got, *i.e.*, coal ranges, gas stoves, &c. The following points must be realised: (1) the children would not always be using the same apparatus, as they were the mothers of the future and ought to have some kind of training in using electrical apparatus; (2) some of the children would be going out into domestic service where they would be working in homes which were electrically equipped.

Lt.-Col. W. A. Vignoles, D.S.O., M.I.E.E., director, British Electrical Development Association, stated that at the present time the electrical industry was suffering from a want of knowledge on the part of the consumers. He referred to the excellent scheme at Barnsley, and also to the fact that Grimsby had installed electric cookers in all the domestic science centres and girls' schools. The E.D.A. would be very pleased to do what it could to provide any instruction which was required, and to collaborate with the E.A.W. in the matter.

Mrs. B. M. Wilson (honorary secretary, E.A.W., Ashford District Branch) gave a report of a student class which had been commenced some two or three months ago, which had been attended by 20 or 30 senior girls, whose average age was 15, and mistresses from the two principal secondary schools in the town. The lectures were given by the local electrical engineer, and had the support of the Electrical Contractors' Association.

Mr. L. L. Robinson, M.I.E.E., borough electrical engineer, Hackney, referred to the fact that the teaching on electrical apparatus was not always given in a practical way in the schools, and read a report from a local school where an electrical installation had been put in. There had been no meter on the electric cooker, and no records had been kept of comparative costs with other methods. He referred to the apathy of the electrical industry in not providing more lecture services for the public and the schools.

Mr. A. C. Cramb, M.I.E.E., honorary secretary, Incorporated Municipal Electrical Association, stated that they had put in an electrical installation in the High School at Croydon some time ago, and electricity had been paid for at the lowest possible price. The teachers had visited the local showrooms. Close co-operation between teaching staffs and the supply undertakings would do a great deal to help along the uses of electricity, provided electricity was supplied at a reasonable price in the district.

Miss Dawson Caves, M.I.H., A.R.San.I. (organiser of Domestic Subjects and Needlework, Cheltenham Education Committee) stated that in the domestic science centres at Cheltenham gas cookers had been installed free of charge, and that electric cookers had been hired at the rate of 5s. per quarter. There was first-class equipment at all centres, for which thanks were due to the Education Committee and also the borough electrical engineer, Mr. Bache. They hoped to have the age raised for girls attending the classes to 15 within a very short time. The Hadow Scheme had been started. All the domestic science teachers were members of the E.A.W., and keenly interested in the lectures given under the auspices of the Association.

Mr. H. E. Hughes, of the E.L.M.A. Lighting Service Bureau, referred to the importance of the correct use of electric light as a subject to be taught in the schools. E.L.M.A. had already done a good deal of work for the domestic science teachers in connection with the giving of lectures, and was always ready to help.

Mr. W. G. Phillips, Association of Teachers in Technical Institutions, stated that he felt that every assistance would be given by the technical colleges in connection with any instruction which might be given relating to domestic electrical appliances. He felt very strongly that lectures should be given on simple household repairs, and said that he would be pleased to give assistance in the matter, outlining a possible course.

The Motor Ship "Highland Brigade."

The new motor ship *Highland Brigade*, one of the five ships of the kind built, or being built, at the Belfast yard of Messrs. Harland & Wolff, Ltd., left Belfast Lough on April 27th for her trial trips, which have been of a successful nature, to London. The vessel is of 14,350 tons, and is propelled by twin-screw Harland and B.W. double-acting 4-cycle engines. She is well equipped with up-to-date electric lighting, and power. The installation consists of four Diesel-driven generators, each having an output of 200 kW at 220 volts. Electric motors are installed to drive all ventilating fans, and all the engine-room and deck machinery, including steering gear, capstans, windlass and winches. The ship is electrically heated throughout and, in addition to electric radiators, each state room is provided with its own ceiling fan and berth light, all being under the control of the passenger. The water-tight doors are electrically controlled and operated from the captain's bridge, where indicators show whether they are opened or closed. The installation on the boat deck, which, while normally lighting for dances, can be swung outboard and give the necessary light for operating the boats. The ship is equipped with a very complete telephone and bell installation, and wireless of the latest type.

The four generators are driven by 6-cylinder trunk motors of the Harland and B.W. type, fitted with specially large compressors which supply the manœuvring air. Two emergency sets are provided in a separate room on the boat deck and connected up with the refrigerating plant so that should the main motors go out of action the refrigerating plant can be kept going.

The *Highland Brigade* will be employed on the Brazil and Argentine route, *via* Spain and Portugal, and carry passengers, 135 first-class, and 66 intermediate, and many emigrants, and cargoes of refrigerated stuffs. She is the third of five sister ships.

British Switchgear for Shanghai.

An order that was secured against international competition was recently shipped to a municipal electricity undertaking in China.

A LARGE metal-clad switchboard for the Shanghai (China) Municipal Electricity Department that was despatched recently from the works of Messrs. A. Reyrolle & Co., Ltd., weighed 125 tons, and was conveyed to Birkenhead in a special train of 25 trucks. The order was secured against international competition, and forms part of a scheme whereby the Shanghai undertaking is extending and strengthening its switchgear installation. The Brennan Road sub-station constitutes an important link of the system, and with a total plant capacity of 161,000 kW at the Riverside station, the switchboard will have a very important duty to perform.

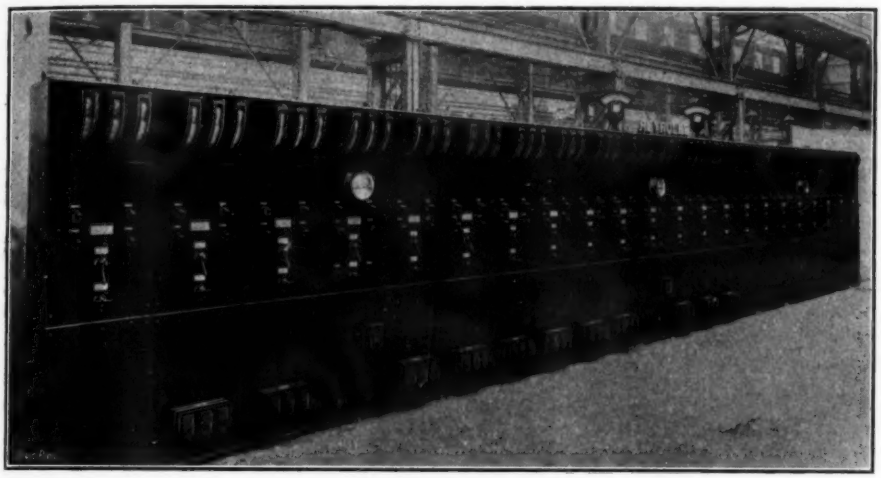


Fig. 1.—Control Board for Switches shown in Fig. 2.

This product of Tyneside is built up of units of the company's duplicate-bus-bar "A2" type, furnished with certain special features to comply with the operating conditions: for example, oil-immersed bus-bar change-over selector switches mounted over the circuit-breakers proper. These enable the load of any circuit to be transferred from one bus-bar to the other without interrupting the supply, and in order to ensure that the bus-bars are in step prior to the change-over, the bus-bar coupler switch is interlocked with the circuit controlling the motors provided for operating the bus-bar selector switches in such a way that unless the bus-bar coupler is closed electrical operation of the selector switches cannot take place.

As is usual in this switchgear, the interlocks protect against inadvertent operation, and they include one that makes it impossible to move the circuit-breaker portion when the selector switch is in an intermediate position, notwithstanding that this condition could only arise if the switches had been operated by hand after withdrawal.

One feeder is of the split-conductor type, and the others have Merz-Price pilot-wire protection. Two have been fitted with the Reyrolle split-pilot system.

Fig. 2 shows the metal-clad switchboard itself, and fig. 1 shows the control board for operating the former; both photographs were taken at the company's Hebburn works before the boards were dispatched.

22,000-V main switchgear has also been supplied by Messrs. Ferguson, Pailin, Ltd., and step-up transformers have been supplied for the station by the International General Electric Co.

In line with the increased capacity of the generating plant, the distribution system is also being increased. New h.p. cables connecting the power station and the various sub-stations have been laid, banks of transformers with units of 4,200 kVA capacity are installed, and new sub-stations distributing at 6,300 V have been built and equipped. The total sale of electricity by the undertaking in 1927 was 400,343,385 kWh. The highest maximum peak load recorded during the year was 90,000 kW.

Fig. 2.—Switchboard of Reyrolle "A.2" Duplicate Bus-bar Units.

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Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

District Joint Industrial Council Meetings.

The annual meeting of the District Joint Industrial Council and the District Joint Board, Electricity Supply Industry (No. 11, South Coast Area) were held at Brighton on May 14th. At a luncheon at the Royal Pavilion, the Mayor of Brighton, in proposing the toast of "The District Council," said that it was essential that collective bargaining should take place between employers and employed. That masters and men were able to refer to an independent authority on which there was equal representation made for the harmonious running of an undertaking. Alderman Ainger, in reply, said that there were far too many men to-day who were busy trying to cause mischief between employer and employed, and it was their duty to put themselves in the place of the men and try to solve the difficulties that arose.

The Marking of Imported Belting.

The Board of Trade has referred to the Standing Committee under the Merchandise Marks Act, 1926, the applications for Orders-in-Council to require the marking with an indication of origin of imported machinery belting, and strap butts of leather. The dates of the Committee's public inquiries will be announced later, and communications regarding them should be addressed to the Secretary, Mr. E. W. Reardon, Board of Trade, Great George Street, S.W.1, not later than June 14th.

The Dublin Electricity Department.

We have received from Dublin an interesting little brochure describing many phases of the activities of the City Electricity Department (engineer: Mr. Laurence J. Kettle). The first part is historical, and traces the growth of the undertaking since its inauguration in 1892. Many photographs of the old and present works are reproduced. The distribution system is then described, and a review of the development and finance of the Department follows. A large section is devoted to domestic electrification, and this is illustrated with views of the fine showrooms, which are situated in Grafton Street, one of the city's most popular thoroughfares. The reasons for the difference in lighting and other rates are briefly stated, and the booklet concludes with a number of illustrations of the principal buildings and undertakings upon the system.

Another publication received from Mr. Kettle is entitled "How Electricity Made Dreams Come True." It tells in a series of advertisements how the troubles of a newly-wedded couple were solved electrically, and includes a number of consumers' testimonials.

Conditions in Finland.

The Stationery Office has published (at 1s. net) for the Department of Overseas Trade a report on economic conditions in Finland by Mr. C. H. Mackie, British Consul at Helsingfors. In this it is stated that after an almost unbroken period of progress Finland suffered a setback in several directions during 1928. It is hoped, however, that this was merely a passing phase. An Economic Council was appointed towards the end of the year to recommend measures for improving the situation, particularly with regard to foreign trade. The immediate outlook appears to be more hopeful. The United Kingdom provided 12.3 per cent. of the total Finnish imports during 1928 (against 14.4 per cent. in 1927), and took 35 per cent (against 40 per cent.) of Finland's exports. In 1928 Finland imported 2,421 metric tons of electrical machinery valued at 69,300,000 Finnish marks (about £350,000); 3,644 tons of insulated wires and cables valued at 35,500,000 marks (about £180,000); and 142 tons of electric lamps valued at 20,000,000 marks (about £104,000). The share of the United Kingdom in this trade is not stated.

Mr. Mackie recommends the appointment of agents within the country selected only after a personal interview. He points out that the distance to Finland is not great and can be accomplished by the shortest route in three days. It is stated that great progress was made in the Finnish telephone service during 1928, and further extensions are in hand both in the country itself and in the connections with neighbouring states. In an appendix to the review it is reported that, after several years of work, the rapids at Imatra are about to be utilised for the production of electrical energy. All the machinery has been installed, the transmission lines are ready, and trials have taken place. It was anticipated that the supply would be commenced early this year.

International Telephone Corporation in Germany.

The International Telephone and Telegraph Corporation through its subsidiary, the International Standard Electric Corporation, is entering into the field of the manufacturing of electrical communication apparatus in Germany by the purchase of a substantial interest in the Ferdinand Schuchhardt Berlin telephone and telegraph works. It is planned to expand this German factory in order to increase its distribution of telephone, telegraph and radio apparatus. In taking this step the International is extending to Germany the benefit of the inventions and technical experience resulting from the world-wide system of the International Standard Electric Corporation and its associated companies. The Ferdinand Schuchhardt factory is one of the oldest of the communication apparatus factories in Europe, and occupies a prominent position in the field. The International Standard Electric Corporation, the principal manufacturing organisation of the International system, has factories in England, France, Belgium, Spain, Italy, Austria, Hungary, Czecho-Slovakia, Australia, China and Japan, with a sales organisation extending throughout the world.

The Shanghai Electricity Department.

In a recent issue we stated that Messrs. Preece, Cardew and Rider were consulting engineers to the Shanghai Municipal Electricity Department. This was incorrect: Messrs. Preece, Cardew & Rider act in the capacity of inspecting engineers and have watched the Department's interests in this country so far as the progress of manufacture of plant and like details are concerned.

New French Companies.

Among the companies recently formed in France are the Société Hydro-Electrique du Drac Inférieur, Grenoble (27, Rue de Turenne), capital 15 million francs, to acquire an interest in a number of hydro-electric power undertakings; La Société Hydroélectrique des Cevennes, Ales (Gard), capital three million fr.; and the Société de l'Union Electrique des Pyrenées Occidentales, Paris (156, Rue de l'Université), capital 12 million fr., to acquire an interest in a number of electricity undertakings in the Western Pyrenees.

Our French contemporary *L'Electricien* reports that a company has been formed in Paris (42, Rue Pasquier), with a capital of one million fr., and the title La Société Stone, to acquire rights for the manufacture of electric lighting equipment for railway trains in France from Lege Reet & Co., Ltd., London. Among the directors of the new concern are Sir John Prestige, Mr. B. W. Preston, and Mr. H. Bissell, all of London.

The New Canadian Customs Regulations.

The Ottawa correspondent of *The Times* reports that the Dominion Government was criticised in the House of Commons on May 14th in connection with its new regulations requiring goods entering Canada to be 50 per cent. British as to labour and material to qualify for preferential treatment. It was declared that the regulations would prove an impediment to British trade and would probably react on Canadian trade with the United Kingdom. The Minister of National Revenue said that the Government's intention was to help Empire trade, and quoted examples of goods which were practically all of Continental manufacture being re-exported to Canada after finishing processes in the United Kingdom. It was complained that copper was one of the materials which British manufacturers could not obtain from Empire sources, but Canada could supply it. The Minister of Finance said that Great Britain, Australia and New Zealand had introduced similar regulations to those in question. However, if it could be shown in any case that British industry could not qualify properly in respect of raw materials obtainable within the British Empire, Canada was prepared to consider modifications of the list of exemptions from the new regulation.

Unemployment in Germany.

The Berlin correspondent of *The Times* says that the German unemployment insurance returns for the first fortnight of April show a marked decline. Between April 1st and 15th the number of persons in receipt of relief decreased by 420,000 or 22 per cent., from 1,900,000 to 1,480,000. The number receiving extended benefit increased from 192,000 to 198,000, so that the total number of registered unemployed on April 15th was 1,678,000.

E.D.A. Activities.

The British Electrical Development Association has planned the June portion of its campaign with a hope that there will be a continuance of warm weather. That is, the subjects are cooling and refrigeration. This, together with the fact that there are three or four electrical conventions during the month, has shown great confidence in June, which we hope will prove not to have been misplaced.

All the usual features of the monthly E.D.A. programmes are retained, *mutatis mutandis*, for June—the national and local Press advertising, posters, publications, lectures and lantern slides, &c. As usual, members are offered a choice between two window displays, both of which are illustrated herewith. They are both planned on simple lines. The one demonstrating electric cooling (fig. 1) consists merely of a few fans mounted at various heights to make an effective show, one of them being in motion and blowing out streamers. In the background there appear the large switch and the campaign slogans which are a feature of all the displays. The cardboard lady who appeared in one of the May window arrangements is given a new lease of life in the second of the June displays (fig. 2). She stands before a well-stocked refrigerator, which demonstrates the variety of food which can be kept in condition by electrical means.

Fig. 1.—An E.D.A. Fan Display.

Fig. 2.—A Refrigerator Window.

Fig. 3.—The E.D.A. Stand at Newcastle.

In our last issue, when dealing with the North-East Coast Exhibition, we made reference to the display which has been arranged by the British Electrical Development Association. We are now able to reproduce an illustration of the stand (fig. 3). This shows the information bureau and one of the sides, which is divided into seven panels each of which illustrates an application of electricity for lighting, heating, cooking and labour saving.

A British Trade Fair in Argentina.

In a recent issue we reported that the British Chamber of Commerce in the Argentine Republic had planned a British Empire Trade Fair, to be held in Buenos Aires from November, 1930, to February, 1931 (the Argentine summer season). We have now received from the Chamber a preliminary prospectus which "sets forth the scope, policy and organisation suggested for carrying the undertaking to a successful issue." Appeals for their assistance and encouragement are addressed to the British Ambassador in Argentina and to the Parliamentary Secretary to the Department of Overseas Trade. The prospectus emphasises the great opportunities which exist in the Republic for British trade, and gives particulars of the sections into which it is proposed to divide the exhibition. These include the heavy and light metal trades, the electrical trades, transport, radio, and many other classes of industry. Two striking aerial views are included; one shows Buenos Aires from the water-front, while the other depicts the beautiful grounds of the Argentine Rural Society which are being lent for the purposes of the Fair.

Book Notices.

"Estimating," by T. H. Hargrave. Pp. viii+120; figs. 40. London: Sir Isaac Pitman & Sons. Price 7s. 6d. net.

"Radio Receiving Tubes," by J. A. Moyer and J. F. Wostrel. Pp. vii+297; figs. 180. Price 12s. 6d. net; "Electrical Engineering Problems," Part II, "Alternating-current Circuits and Apparatus," by J. G. Pertsch, Junr., and E. M. Strong. Pp. vii+105; figs. 48. Price 7s. net. London: McGraw-Hill Publishing Co., Ltd.

Art and humour are again skilfully combined in the 1929 Summer Number of *Punch* (1s. net). A number of our contemporary's regular contributors have co-operated in the production of an annual which is always anticipated with pleasure.

"*Journal* of the Institution of Electrical Engineers," Vol. LXVII, No. 389. May, 1929. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Canadian Copper Production.

The *Board of Trade Journal* states that, according to statistics published in the Preliminary Report on the Mineral Production of Canada during 1928, the Dominion is the world's fourth most important producer of copper, with every prospect of becoming the third greatest source of the red metal within the next eight or ten years, being then surpassed only by the United States and Chile. At present, Africa also produces more copper than Canada. Producing 201,940,172 lb., or 100,970 tons, in 1928, Canada showed an advance of more than one-third over 1927. British Columbia was responsible for more than half of the copper produced.

Wages in the Cable-making Industry.

The Joint Industrial Council for the Electrical Cable Making Industry informs us that as the B.O.T. cost-of-living index figure on May 1st was 61 per cent. above the 1914 level, there will be no change in wages on the third pay day in June, 1929, in the industry.

British Industries Fair Catalogues.

As in previous years, the Department of Overseas Trade is drawing attention to the fact that the catalogues of exhibits at this year's British Industries Fair at London and Birmingham form a very useful buyers' guide to British goods. A limited number of the catalogues is still available, and can be obtained at the price of 1s. each, post free, from the Department, 35, Old Queen Street, S.W.1.

The Swedish Industries Fair.

The Swedish Industries Fair will be held at Gothenburg from May 25th to June 2nd in the magnificent exhibition building of 30,000 sq. metres floor area, which was originally erected for the engineering section of the Gothenburg Exhibition a few years ago. It is said to be the largest timber structure of its kind in the world. The Fair this year will be particularly comprehensive, and certain sections, such as electrical apparatus, paper, wireless, and a separate department of inventions should be especially attractive and interesting. Last year the number of exhibitors was 700, representing about 1,400 Swedish manufacturers. The visitors numbered 106,000 from 22 countries.

For Sale.

Messrs. Fuller, Horsey, Sons & Cassell will sell by auction, at the depôt adjoining the main entrance of the Wembley Exhibition Grounds, on June 19th, electrical plant and stores removed from the Wembley Exhibition. (See our advertisement pages to-day.)

Topical Showcards.

Many advertisers have seized the opportunity provided by the General Election for effective publicity. The General Electric Co., Ltd., for instance, has produced two showcards in colours bearing on the political situation. One of these bears portraits of the leaders of the three parties and asserts that all parties agree that "Osram" valves are best. The other counsels the reception of election results by means of "Gecophone" radio receivers and loud speakers.

Bankruptcy Proceedings.

G. Ranger, motor and wireless dealer, 1889, Pershore Road, King's Norton, Birmingham.—Receiving order made May 9th on a creditor's petition.

C. B. Marsden, electrical engineer, rear of 60, Pisgah Street, Kenfig Hill, Glamorgan.—Receiving order made May 11th on debtor's own petition. First meeting May 30th, at 34, Park Place, Cardiff; public examination June 20th, at the County Court, Bridgend.

J. Stirzaker, electrical engineer, late of Wen Roe, Llanfairfechan.—First meeting held May 23rd at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester. Public examination May 31st at the Court House, Bangor.

J. H. McBean (H. W. D. Battery Co.), electrical engineer, 29, Bradford Road, Batley Carr.—First meeting held May 23rd at the Official Receiver's office, 12, Duke Street, Bradford. Public examination June 6th at the County Court House, Dewsbury.

H. Peover, electrical apparatus and tool merchant, Market Lane, Newcastle-upon-Tyne.—First meeting held May 22nd, at the Official Receiver's office, 81, St. Mary's Place, Newcastle-upon-Tyne. Public examination June 6th, at the Court House, 56, Westgate Road, Newcastle-upon-Tyne.

E. E. Harrison, electrician, 27, School Lane, Heaton Chapel, Lancaster.—First meeting May 24th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, June 28th, at the Court House, Stockport.

G. M. Wilshaw & G. Sharpe (Wilshaw & Sharpe), electrical dealers, 320, Padiham Road, Burnley.—First and final dividend of 2s. 6¼d. in the £ payable at the Official Receiver's office, District Bank Chambers, Blackburn.

S. Perkins, wireless dealer, 1, Lodge Lane, Beeston, Leeds.—First and final dividend of 1s. 9d. in the £ payable May 24th, at the Official Receiver's office, 24, Lower Bond Street, Leeds.

D. B. John (D. B. John & Bros.), electrical engineer, &c., 8, Commercial Place, Pontycymmer, and Nanthir Stores, Nanthir Road, Blaengarw, Glam.—Receiving order made May 13th, on debtor's own petition. First meeting May 30th, at 34, Park Place, Cardiff; public examination June 20th, at the County Court, Bridgend.

E. R. D. Lindsay, wireless and cycle agent, 96 & 98, Victoria Road, Aldershot.—Application for discharge to be heard June 6th, at the Guildhall, Guildford.

G. S. Douthwaite (G. S. Douthwaite & Co.), electrical engineer, 25, Dean Street, Newcastle-upon-Tyne.—Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-upon-Tyne, released March 15th, 1929.

W. H. Edwards, electrical engineer, The Docks, Milford Haven.—Last day for proofs for dividend May 31st. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

Company Liquidations.

Telephones & Accessories, Ltd.—A petition for the winding up of this company has been presented to the High Court by the Erewash Electric Wire Co., Ltd., of Bennett Street, Long Eaton, Derby. Creditors, &c., will be heard in London on June 4th.

Electric Factors (Blackpool), Ltd.—A meeting of creditors is called for May 30th at the Arcade Café, Feldman's Arcade, Central Beach, Promenade, Blackpool.

Church Stretton Electric Supply Co., Ltd.—A meeting of members is called for June 12th, at 1c, King Street, St. James's, S.W., to hear an account of the winding up from the liquidator, Mr. A. E. Dalton.

Whitfield Electrical Co., Ltd.—First meeting of creditors and contributories, May 27th, at 29, Russell Square, W.C.

Deeds of Assignment.

Mrs. Nina Rayner, trading as D. D. Rayner & Co., electrical engineers, Derby.—The trustee in this matter, Mr. J. M. Sibbald, 41, St. Mary's Gate, Derby, reports that judgment against the surety remains unsatisfied and he is assured that there is no prospect of recovering any payment. He therefore proposes to distribute the balance in his hands in accordance with the deed of assignment.

S. C. Smith, wireless and electrical engineer, 10, The Facade, Devonshire Road, Forest Hill.—Particulars of claims by May 31st, to the trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.2.

A. Rutherford, electrical engineer and contractor, Plowman's Yard, Church End, Finchley, N.3.—Particulars of claims to the trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C.2, by May 31st.

New Catalogues and Lists.

Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.—Pamphlet No. 465, illustrating, with prices, various designs of fans.

H. J. Galliers, The Electric Shop, 167, North Street, Brighton.—The 3rd monthly issue of "Galliers' Electrical Bulletin," including notes on lighting ideas, country house electrical installations, &c.

Veritys, Ltd., Aston, Birmingham.—Publication 1070, showing "Orbit" oscillating fans. Priced. Publication 1069 dealing with "Verity-Heemaf" high-torque motors, with stock list; also a new price list of "Aston" switchgear.

Arthur Preen & Co., Ltd., Crown Works, Cricklewood Lane, N.W.2.—Illustrated folders giving instructions for the construction and operation of the "Screen Grid Three" wireless set, and describing with prices "Formo" radio components.

The Power Centre Co., Ltd., 15, Park Lane, Liverpool.—An illustrated leaflet describing the "Turret" patent trunk cable conduit system.

Metro-Vick Supplies, Trafford Park, Manchester.—An illustrated folder drawing attention to the company's electric fans.

David Brown & Sons (Huddersfield), Ltd., Park Works, Lockwood, Huddersfield.—A well-produced booklet entitled "Worm Gear Transmission," being a general review of the development and possibilities of the worm drive.

Elliott Brothers (London), Ltd., Century Works, Connington Road, Lewisham, S.E.—A folder dealing with the firm's portable testing instruments.

Mica Manufacturing Co., Ltd., Volta Works, Bromley, Kent.—Price list of electrical spotted mica.

Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—A pamphlet giving historical details of Jervaulx Abbey and the electrical installation there, including a Chloride battery of 54 cells.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—Two leaflets, priced and illustrated, describing the Philips aerial discharger, and 2- and 3-valve "all-electric" receivers.

Siemens Electric Lamps & Supplies, Ltd., 38 & 39, Upper Thames Street, E.C.4.—May price list of lighting fittings, "Xcel" domestic appliances, &c.

Recent Contracts.

Contracts for electric lighting installations in the following buildings have recently been placed with Messrs. G. E. Wallis and Sons, Ltd., Ashford, Kent:—Raglan Road Council School, Bromley; new telephone exchange, Farnborough, Kent; Gordon School, Gravesend; new telephone exchange, Herne Bay; new telephone exchange, Pembury, Kent; and new telephone exchange, Southborough, Kent.

Messrs. Joseph Kaye & Sons, Ltd., Leeds, have recently secured an order for their patent mortice door locks to master key for the extensions at Barking power station.

Unemployment.

The number of persons on the registers of the Employment Exchanges for the week ended May 6th, showed a decrease of 31,108. At that date the total was 1,132,700, as compared with 1,163,808 on April 29th, and 1,103,822 on May 7th, 1928.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, May 22nd: No change in copper and lead prices.

Messrs. Edward Till & Co. report, May 22nd: India-rubber, Para fine, 11½d., ½d. inc.

Messrs. James Forster & Co., reporting on May 18th, stated that a little better demand for lead was experienced last week from home consumers, but, with freer arrivals, this had little effect on prices. Continental demand is still very quiet and is being easily met by sales of American and Mexican lead. It is reasonable to expect, with the General Election out of the way and the reparations questions settled, an improved demand from consumers both here and on the Continent. On the other hand, with the position in Mexico back to normal, more lead from that quarter is to be expected, while shipments from Australia should be plentiful. The Board of Trade Returns for April, 1929, show:—Imports, 25,415 tons; exports, 2,009 tons; leaving for home consumption, 23,406 tons.

Lighting and Power Notes.

Argentina.—BUENOS AIRES.—The report of the Compania Italo-Argentina de Electricidad for the year ended December 31st last states that work on the construction of Section VI of the new port, where the large new power station is to be erected, was completed, and the construction of the first section of the station, which will have a capacity of 100,000 kW, was commenced. The ultimate capacity of the station will be from 300,000 to 350,000 kW. At the Pedro Mendoza power station the last four boilers were installed. The length of cables laid increased by 534 km. to 2,732 km., and fifty new sub-stations were put into service, bringing the total up to 190, with an installed capacity of 42,865 kVA. The total connected load was 142,350 kW, an increase of 23,107 kW, and the sales of electrical energy amounted to 109,333,915 kWh.

Blairgowrie (Perthshire).—ELECTRICITY SUPPLY.—The convener of the Electricity Committe has reported to the Town Council that the general manager of the Grampian Electricity Company has assured him that Blairgowrie will be supplied with electricity in time for next lighting season. Work has been delayed owing to the winter but is now well in hand. The maximum price is to be 8d. per kWh for lighting, and 3d. for power.

Brackley.—STREET LIGHTING.—The Town Council has decided to accept the tender of the Northampton Electric Light Co. to light the streets of the town for the next ten years. This tender includes the fixing, lighting, and maintenance of 52 lamps for ten years at a net cost of £186 per annum.

Bradford.—MAINS EXTENSIONS.—The Corporation Electricity Committee has sanctioned further expenditure on extensions of mains, &c., up to a total of £20,000.

LOAN.—The Committee is seeking sanction to a loan of £20,000 for estimated expenditure on transformers and sub-station switchgear during the next three years.

Canada.—ELECTRICAL DEVELOPMENT.—The preliminary report of the Dominion Bureau of Statistics on the central electric station industry in Canada for 1927, shows that the total overhead line mileage increased by 3,878, or 13 per cent.; and the output was greater by 2,455,654,000 kWh, or 20 per cent., for an increase in total primary power of 404,026 h.p., or 11 per cent. Commercial stations produced 2,149,193,000 kWh, or 27.6 per cent. more than in 1926, and municipal stations showed an increase of 7.4 per cent. The principal increase was in Quebec, where privately-owned plants increased their output by 1,594,879,000 kWh, or 32.6 per cent. Hydro-electric stations in Canada in 1927 generated 98.6 per cent. of the total amount of electrical energy produced. The number of power plants increased during the year by 34, of which hydro-electric plants numbered 8 and fuel plants 26, most of the latter being in Saskatchewan. The population served by central electricity stations was approximately 5,830,000, or 61 per cent. of the total estimated population of the Dominion.

Carlisle.—LOANS.—The Corporation Electricity Committee is to lay an additional feeder between Willow Holme and Holme Head works, and has instructed the town clerk to obtain sanction to borrow £3,500 to cover the cost. The Committee is also to seek sanction to loans of £15,000 for mains and services, and £5,000 for the purchase of meters.

Continental.—BELGIUM.—The Société d'Electricité Interbrabant which last year acquired the power station at Droogenbosch belonging to the Imperial Continental Gas Association and the station at Schaerbeek, Brussels, of the Société Bruxelloise d'Electricité has decided to proceed immediately with the extension of the Schaerbeck plant from 80,000 to 160,000 kW by the addition of four 20,000-kW turbo-generators. The new building will be constructed so as to provide for the addition of two further sets of similar capacity at a later date. The company is also proceeding with a big power station interconnection scheme so that in the event of any breakdowns the load may be taken over by other plants and the two stations at Droogenbosch and Schaerbeek have already been linked up. A similar linking operation is about to be effected between the stations of the Interbrabant Co. and those of the Brussels municipality and of the Brussels Tramway Co., and that at Oisquercq of the Société des Centrales Electrique des Flandres et du Brabant.

ITALY.—The Società Elettrica dell' Adamello has recently completed a new hydro-electric power station at Sonico in the Alte Valle Camonica. The plant, which works under a head of about 1,426 ft., comprises five Pelton-type turbines direct coupled to 16,000-kVA alternators generating at 42 and 52 cycles 7,000 V and from 420 to 500 r.p.m. The installation also includes an outdoor 7/130-kV transformer plant.

BULGARIA.—A report recently issued by the Bulgarian State Water Department shows that the number of hydro-electric power stations in Bulgaria increased from about 20 in 1918 to 139 at the end of 1927. The output in the last mentioned year amounted to 25,635,000 kWh, of which 15,192,000 kWh were produced by one station. At the end of 1927 there were also 109 steam-operated electric power plants in the country, of which, however, 69 had a capacity not exceeding 100 h.p., only two being of more than 2,000 h.p. The total output of the steam stations in 1927 is given as 11,097,000 kWh.

HUNGARY.—Considerable improvements have been made during the past year in the equipment of the electric power plant of the Hungarian coal mines. The Government has approved the so-called "Talbot" concession authorising the construction of a large electric power station at Banhida, in the heart of the Tata coal-field district. It will utilise annually about 300,000 tons of the peat of the district, and will produce electrical energy for Budapest and other cities as well as works, factories, and mines within a projected radius of about 100 miles. The plant is to be completed by the end of the present year.

Federated Malay States.—PENANG.—According to *Eastern Engineering*, rapid progress has been made by the municipal electricity supply undertaking serving Georgetown and the Province of Wellesley, and 8,000 consumers have now been connected. Capital expenditure amounting to £100,000 has been authorised to cover extensions from 1930 to 1932. This includes £35,000 for a submarine cable from Prai to Presgrave, and £23,000 for a new 5,000-kW turbo-generator. It is reported that consideration is being given to the advisability of installing a 10,000-kW set instead of the 5,000-kW set at present proposed.

Hastings.—STREET LAMPS.—The Corporation is to extend mains and provide street lamps at a cost of £1,500.

ELECTRICITY SUPPLY.—The Corporation Electricity Committee is to provide a supply of electricity to Crowhurst at a cost of £7,500.

Irish Free State.—WATERFORD.—The Mayor recently performed the ceremony of switching on the new electricity supply. Waterford is the first provincial city in Ireland to receive electricity *via* Dublin under the Free State Government national electrification scheme.

London.—HAMMERSMITH.—In connection with the extension of Olympia, the Electricity Committee has recommended the provision of two 6,600-V, three-phase mains with transformers and switchgear, at a cost of £13,087.

SHOREDITCH.—The Lighting Committee has recommended the expenditure of £13,183 for mains extensions, and also £10,000 for the provision of prepayment and other meters.

Lothians.—MAIN TRANSMISSION LINES.—By the closing of an 11,000-V switch on May 11th, Mr. W. B. Cownie, the managing director of the Lothians Electric Power Co., completed the last section of the main transmission lines in East Lothian; this took place at the company's Belhaven sub-station. He subsequently welcomed Baillie Mel aren of Dunbar, and invited him to close the 3,000-V switch which gave a supply of electricity to Dunbar, Belhaven and West Barns.

Lowestoft.—YEAR'S WORKING.—The report of the Mayor on last year's working of the Electricity Department shows that, in spite of the present uneconomical double system of supply resulting from the purchase of a partial bulk supply from Yarmouth and of a reduction in price of electricity for lighting and heating purposes, the total income was £48,732, an increase of £512 on that of the preceding year. Working expenses, sinking fund and interest absorbed £46,417, of which £10,918 was paid in sinking fund charges. Generation and bulk supply costs showed an increase of £4,023, while the interest and sinking fund charges were increased by £512. There was, however, a balance of income over expenditure of £2,315. In the reserve and renewal fund there was a credit balance of £9,136. The assisted wiring scheme and hiring-out of cookers has been very successful. In four months 175 new consumers have been connected and over 100 cookers hired out.

Manchester.—PROGRESS DURING MARCH.—During the month of March the Corporation electricity undertaking showed an increase in connections of 8,292 kW, bringing the total up to 382,140 kW; and the number of applications received for supply, including those for additional supplies, was 1,271, representing a total of 2,124 kW. The number of hired cookers connected increased by 70, bringing the total of hired cookers actually connected to 5,182. Applications for the hire of cookers totalled 98. Two new sub-stations were put into commission, and additional plant was installed at three existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 5,061 consumers up to April 13th last and sanction had been given and work was in progress involving 1,045 consumers.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

ALDERLEY EDGE AND WILMSLOW.—Lighting: To 8d. per kWh. Power and heating: To 3d. per kWh.

STOCKTON-ON-TEES.—Lighting: From 4d. to 3½d. per kWh, and 3½d. above 1,500 kWh. Heating: From 1½d. to 1¼d. per kWh. Power: From 2d. to 1¾d. per kWh, and 1¼d. above 5,000 kWh. Alternative rate for private houses: 1s. 9d. per quarter per 100 sq. ft. of floor area, plus 1d. per kWh for the first 240 kWh per quarter for any purpose, and ½d. per kWh beyond. Tramway supply: From 1¼d. to 1d. per kWh. In the parishes of Preston and Eaglescliffe.—Lighting,: From 5¼d. to 4¼d. per kWh. Heating: From 2d. to 1¼d. per kWh. Power: From 3d. to 2d. per kWh. Domestic rate: From

2s. 9d. per quarter per 100 sq. ft. of floor space to 2s., plus 1d. per kWh for any purpose.

Wallingford.—*Wallingford & District Electric Supply Co., Ltd.*—Lighting: From 1s. to 10d. per kWh.

Scarborough.—Loan.—The Town Council is to apply for sanction to a loan of £17,000 for further plant, including a turbo-alternator, in connection with the scheme of bulk supply to Bridlington and the parishes in the Filey district, required in 1930-31, by which time the Bridlington station is expected to have reached its total possible output. The scheme has been the subject of consultations with the Electricity Commissioners and the Central Electricity Board.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Dorking Electricity Supply Co., Ltd., to supply electricity in the urban district of Dorking and parts of the rural districts of Reigate and Dorking.

The Minister of Transport has confirmed the Special Order made by the Commissioners authorising Hull Corporation to supply electricity in the boroughs of Beverley and Hedon, the urban district of Cottingham and parts of the rural districts of Beverley, Skirlaugh, Sculcoates and Patrington.

Stirlingshire.—Street Lighting.—Arrangements for the public lighting of the villages of Cowie, Plean, and Fallin have been completed by the County Council. Electricity is to be supplied by the Scottish Midlands Electricity Supply Co. and carried by l.p. overhead distributors for street lighting. It is expected that the scheme will be in operation by the beginning of the next lighting season.

Swansea.—Mains Extensions.—The Corporation Electricity Committee is to extend mains to Ynystawe at a cost of £2,000.

Power Station Plant.—The Finance Committee has approved the purchase of the proposed 10,000/12,500-kW turbo-generator for the Strand power station at a cost of £34,476.

United States.—Electrical Development.—A £6,000,000 project to harness the Osage River in the State of Missouri is announced by the president of the North American Company. The new plant will form part of a system supplying a population of 1,300,000, scattered over an area of 2,700 sq. miles. Steel tower transmission lines will carry the power to Crystal City, where one firm has entered upon a long-term contract calling initially for 150,000,000 kWh per annum. A concrete dam over 100 ft. in height is in the course of construction. The plant is to have an initial capacity of 120,000 kW, with provision for additional units up to 160,000 kW capacity.

According to *Power*, ground has been broken at Sayreville, N.J., for the erection of a new power plant to be operated by the New Jersey Power Company, a subsidiary of the Utility Power and Light Corporation. The initial installation will be 60,000 kW in two 30,000-kW units, and this capacity will be increased to 180,000 kW as the demand for power in eastern and central New Jersey justifies the expansion. Steam at 400 lb. pressure and a total temperature of 700 deg. F. will be generated by four 12,000 sq. ft. boilers, stoker fired and equipped with air preheaters, &c. It is anticipated that the plant will be ready for operation by April 1st, 1930.

Warrington.—Electricity Supply.—Mr. F. V. L. Mathias, borough electrical and tramways engineer, has submitted to the Electricity and Tramways Committee a report dealing with the supply of electricity to High Legh, Warburton, and Agden. These districts, which immediately abut the eastern boundaries of the Lymm area of the Corporation supply, are chiefly residential and agricultural in character, and the demand would, therefore, be mainly for lighting, cooking and heating, with a certain proportion of power load. There is no gas supply in these districts and it is probable that the requirements in three years will amount to 161,000 kWh, with a demand of 98 kW.

Tramway and Railway Notes.

Bradford.—Light Railway Abandonment.—In connection with the water department, the Corporation a few years ago constructed a railway to Nidd Valley. The Water Committee of the Corporation now reports that, in view of particulars submitted showing progressive diminution of passenger traffic on the Nidd Valley Light Railway, the committee authorised the engineer to take preliminary steps with a view to closing the railway for public passenger transport. Meanwhile it is recommended that reduced fares should be introduced with a view to meeting the omnibus competition which has arisen between Pateley Bridge and Lofthouse.

Continental.—Spain.—According to the *Révue Générale des Chemins de Fer*, a considerable amount of activity is projected in connection with the electrification of railways in Spain, following the presentation of a report by a technical commission appointed by the Ministry of Public Works to investigate the question. This commission recommends the electrification of the lines: (*a*) Madrid-Avila and Villalba-Medina des Campo via Ségovie, northern section; (*b*) Encina-Valence and Cuenca-Valence; (*c*) Madrid-Villanuera de la Reina; (*d*) Catalan section; (*e*) Miranda-Bilbao and Cordillère Cantabrique. The reinforcement of bridges will be put in hand in order to permit heavy trains to pass from Zuera to Turinana. These plans involve 2,200 km. of line and the provision of from 150,000 to 200,000 h.p. It is estimated that present installations will be sufficient to provide this energy, and it is understood that the Ministry of Public Works will invite tenders for the rolling stock and various other requirements.

Switzerland.—The St. Gall-Gais-Appenzell tramway is to be electrified.

Austria.—Electric trains are now running over the section of the Austrian State railways between Innsbruck and Lake Brenner. The power is being drawn from the power stations at Ruetz and Achensee by means of two 55 kV transmission lines. For express passenger trains 2,760-h.p. electric locomotives, capable of a speed of 62½ m.p.h. are being used and for freight trains 1,800-h.p. engines with a speed of 31½ m.p.h. As compared with the old steam trains a saving of time of respectively 28 per cent. and 42 per cent. is being effected by passenger and freight trains between the two terminals of the section.

Japan.—Tramway Developments.—According to the recently-issued report of the Japanese Government Department of Railways for the year ended March, 1927, there were at that date 156 tramway undertakings with a total mileage of 1,668 in operation in Japan. Of the total 88 with a mileage of 1,142 were electrically operated. At the end of the year 106 new tramway routes with a total of 663 miles were under construction, 68 of them being electric.

New Electric Railways.—A new high-speed electric railway is being planned between Kyoto and Kobe, *via* Osaka. The Tsukuba High-speed Electric Railway Co., Ltd., also proposes to build a short underground electric railway from Nippori to Ueno.

Lowestoft.—Year's Working.—The report of the Mayor on the year's working of the tramway undertaking shows a total income from trams and 'buses of £22,484, an increase of £471 on the previous year's receipts. Working expenses, interest and sinking fund absorbed £20,371, leaving a balance of £2,113, as against £1,935 in the preceding year. On the loan account the total amount paid off is £51,276, leaving £39,901 outstanding. The total number of passengers carried was 3,471,632, an increase of 107,436 on the preceding year.

Manchester.—Tramway Abandonment.—Details are being prepared for the Tramways Committee with regard to the proposal to substitute about 70 'buses on the circular route from Cheetham Hill Road to Stretford Road. The 'buses, which will be of a special type, will cost about £100,000, and the road alterations will amount to about £33,000.

Nottingham.—Railless Cars.—The Corporation Tramways Committee has decided to extend its railless car system and to discontinue tramway services in the two areas of the city traversed by St. Ann's Well Road and Wilford Road. The system is also to be employed on the new arterial thoroughfare which has been constructed communicating with London Road.

United States.—Railway Electrification.—One of the greatest engineering feats in American railway history has been brought to a successful conclusion with the recent completion of a tunnel 7¾ miles in length through the Cascade Mountains by the Great Northern Railway Co. at an expenditure of about $14,000,000. Coincident with the opening of this tunnel has been the electrification of 75 miles of main-line track through the Cascades between Wenatchee and Skykomish, Wash., bringing the total expenditure for the improvement to approximately $25,000,000.

Telegraph and Telephone Notes.

Fernando Po.—Short-wave Wireless.—Some time ago the Spanish Government decided to establish a direct wireless service between Madrid and the Spanish Colony, Fernando Po, in Equatorial Africa. The principal Spanish and foreign wireless companies competed for the supply of the apparatus and the specification of Marconi's Wireless Telegraph Co., Ltd., for a short-wave transmitting and receiving station was approved and its tender accepted. In addition, an order was given to Marconi Co. for a medium-wave valve transmitter and receiver to replace the existing medium-wave spark station in the Colony, which is used for working to ships and neighbouring colonies and can no longer be regarded as sufficiently up-to-date. The geographical position is not an ideal one for the reception of long-wave signals from Europe, owing to the Colony's close proximity to the equator, but short-wave signals from Europe are received with regularity and accuracy. The transmitter which is required to work with ships and

neighbouring countries uses medium-waves, because the new International Washington Regulations provide that ships shall work on wavelengths between 600 and 800 metres, or between 2,600 and 2,400 metres. The short-wave transmitting and receiving gear has been installed at Fernando Po, and tests with Madrid have given excellent results. It is of the type used for British Imperial beam stations, but of smaller power and simpler design, owing to the fact that it is required to work on one wavelength only. The short-wave receiver is the Marconi-Mathieu standard.

The medium-wave apparatus consists of a Marconi 1½-kW Type "U" valve transmitter suitable for telegraphy on continuous-waves and interrupted-continuous-waves on wavelengths between 600 and 1,200 metres, which range can be extended by the provision of extra tuning coils to 3,000 metres. The medium-wave receiver is a Marconi type RG.6a, for wavelengths between 300 and 3,000 metres. The existing spark station at Fernando Po will be transferred to Bata in the Spanish Colony Rio Muni, on the African Mainland, and will be used for communication with Fernando Po when the new medium-wave valve gear has been installed.

Germany.—RADIO-TELEPHONY.—Conversation by telephone between Berlin and Sydney was recently carried out experimentally by the Trans-Radio Co. The experiment was a great success, the voices at both ends being perfectly audible.—*Reuter's* (Berlin).

Irish Free State.—TELEPHONY AND TELEGRAPHY.—In Dail Eireann on May 15th the Parliamentary Secretary to the Ministry for Posts and Telegraphs made a detailed statement on the finances of the Department, which he said was not altogether self-supporting, but was as near to it as possible, taking into account the circumstances controlling it. The estimated revenue for the year was £1,771,000, and the estimated deficit was £502,435, as compared with £669,995 last year. The estimated revenue of the telephone service during 1928-29 was £343,000. The telephone service definitely took second place amongst the activities of the Postal Department; it took precedence of the telegraph service, and was gradually expanding and increasing, while the telegraph service was expanding also. Revenue from telephony had increased by £29,000, and with regard to increased charges for telegrams, they anticipated a revenue of £66,000. The employment of the Department totalled 12,532 persons.

Spain.—NEW WIRELESS STATIONS.—With a view to establishing direct telegraph communication with America and eliminating dependence upon London and Paris as is the case at present, the National Trans-Radio Co. is erecting a short-wave wireless station at Aranjuez, a country town some thirty miles from Madrid. Work is being pushed forward as much as possible in order that the station may be completed before the meeting of the Council of the League of Nations, which is to be held in Madrid at the beginning of June, as the Arenjuez station will be the means of communicating with all other countries. The company also intends to erect transmitting stations in the more important commercial centres, such as Bilbao, Barcelona and Seville. In view of the need for completing the Aranjuez station as soon as possible, the materials used in its construction have been imported, but in the case of the other stations to be erected as much of the material as possible will be Spanish.—*Reuter's* (Madrid).

The Telephone Service.—NEW EXCHANGES.—An automatic telephone exchange was recently inaugurated at Churchstoke. It is the second of its type to be installed in the Chester district.

The change over to the new automatic system at Walsall took place recently also. The plant deals with 2,460 subscribers, and is capable of extension to 5,000 lines.

Radio Notes.

Czecho-Slovakia.—NEW STATION.—Test transmissions of the new broadcasting station at Bratislava have been heard in all parts of the British Isles. Out of 479 reports from Great Britain that were specially analysed only 20 indicate the use of more than four valves, the most popular receiver appearing to be the three-valve type, says *The Times*. A number of listeners claim that it is well up to the standard of the principal European high-power stations. The station comprises a Marconi 12 kilowatt transmitter, type PA.5, employing low-power modulation, and among its features is the half-wave-length aerial, the first of its kind to be used in the broadcast band to give the maximum local service area and to minimise fading at greater distances.

Common Wavelength.—PLYMOUTH.—On May 17th the Plymouth station was added to the list of B.B.C. relay stations operating on the national common frequency of 288.5 metres.

Poland.—LICENCES.—The total number of licensed listeners increased during the first three months of this year from 189,481 to 202,561. The number of "pirates" is supposed to be very substantial. Most of the listeners are in the urban districts, a comparatively insignificant number of sets being registered in the rural regions. The largest number is in West, South-West and Central Poland.

Holland.—TRAMWAY DISTURBANCE.—The Commission appointed by the Burgomaster and Council of The Hague to inquire into the disturbances of radio reception by tramways has asked for, and been granted, its discharge on the grounds that any further inquiries can only be profitable if made by an engineer familiar with the various factors of such disturbances and that the matter is one which concerns not only The Hague, but all large cities. One of the tasks of the Commission, says *World-Radio*, has been to induce leading authorities to agree to act whenever occasion arises, which has been done.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ayr.—District Committee. Installation of electric wiring in the District Fever Hospital, Old Cumnock. Specifications from Mr. J. MacEwan, consulting engineer, 62, Robertson Street, Glasgow.

Town Council. Electrical work at 36 houses. Plans at office of Mr. W. Cowie, architect, 5, Wellington Square, Ayr; schedules (£1 deposit) from Town Clerk.

Belgium.—ANTWERP.—June 17th. Municipal Council. 32 electric travelling cranes for the new dock. (Cahier des charges No. 755.) (A.X. 7924.)*

Chile.—VALPARAISO.—June 1st. Port Administration. Four three-metric-ton electric travelling cranes.

Croydon.—June 3rd. Electricity Department. Supply, delivery, and erection of one 20/25,000-kW turbo-alternator, with auxiliaries, boiler-house extensions with two 100,000-lb. boilers, coal handling plant, &c., engine room extension, switchhouse, bridges, and pump house, and 6,600-V switchgear, transformers, &c. (May 10th.)

Dundee.—June 5th. Town Council. Electrical installation at housing scheme. Particulars from Mr. G. Baxter, director of housing.

East Ham.—June 12th. Education Committee. Installation of electric lighting at Salisbury School. Specification 10s., from F. H. Thompson, secretary, Town Hall, East Ham.

Eccles.—May 29th. Health Committee. Installation of electric light wiring and fittings in 68 houses, Westwood Park, Morton. Specification and form of tender from borough electrical engineer, Electricity Works, Cawdor Street, Patricroft. (Deposit £1 1s.)

Edinburgh.—May 30th. Electrical installation at George Heriot's School, Edinburgh. Specifications from Mr. John Anderson, superintendent of works, 20, York Place, Edinburgh.

Epsom.—May 25th. Electricity Department. Supply, delivery and erection of a l.p. d.c. switchboard. (May 10th.)

Grimsby.—May 31st. Electricity Department. Electrically-driven boiler feed pump. (May 17th.)

Hastings.—June 3rd. Boiler fuel for period commencing July 1st, 1929. (May 10th.)

India.—May 27th. India Stores Department. 500-kW, 6-phase, rotary convertor, starting panel, &c. (B.X. 5279.)*

May 31st. South Indian Railway Co., Ltd. Supply of spare parts for train lighting cells and v.i.r. cotton and silk covered copper and galvanised iron wire. (May 17th.)

London.—CENTRAL ELECTRICITY BOARD.—June 17th. Supply, delivery and erection of 33-kV and lower voltage switchgear for the North-West England and North Wales Electricity Scheme, 1928. (May 17th.)

ST. PANCRAS.—June 6th. Electricity Department. Supply of one 1,000-kW motor convertor. (May 17th.)

Commissioners of H.M. Works.—June 3rd. Supply of fuse boards and switches. (See this issue.)

Metropolitan Asylums Board.—June 12th. Installation of two electric passenger lifts at Colindale Hospital, fire alarm system at High Wood Hospital, and electric bell system at Wandsworth casual ward. (See this issue.)

Central London School District. June 8th. Four motors, switchgear equipment, steel shafting, leather belting, &c. (See this issue.)

Manchester.—May 28th. Tramways Committee. Electrical equipments, trucks, and air brakes, for tramcars. Specifications and forms of tender from general manager, Corporation Tramways, 55, Piccadilly, Manchester.

New Zealand.—Wellington.—June 16th. Posts and Telegraph Department. Telephone bells. (B.X. 5272.)*

August 13th. Public Works Department. Water turbine-driven generating sets and switchgear for Waitaki. (B.X. 5278.)*

Ogmore and Garw.—May 31st. Electricity Department. A short length of 11-kV transmission line, and l.p. overhead and underground mains. (May 10th.)

South Africa.—Johannesburg.—June 1st. Town Council. Truck type cubicles. (B.X. 5285.)* Oil switches. (B.X. 5283.)*

Pretoria.—June 27th. Posts and Telegraphs Department. Automatic wall and table-pattern telephones. (B.X. 5273.)*

Stockton-on-Tees.—June 11th. Electricity Department. Supply and delivery of two 1,250-kVA 3-phase transformers and l.p. 3-phase switchgear. (See this issue.)

Uruguay.—Port Authorities.—July 22nd. 300-kilo electro-pneumatic drop-hammer. (A.X. 7974.)*

Walthamstow.—June 12th. Electricity Department. Supply, delivery and erection of two cooling towers and one ferro-concrete tank. (See this issue.)

West Ham.—June 17th. Education Committee. Installation of electric lighting at Fyfield open-air school extension, and installation of water-heating apparatus at Balaam Street School, Plaistow. (See this issue.)

Yorks.—May 31st. West Riding Education Committee. Electric light installation for the Malty Craggs and Aston Schools. Mr. A. Adcock, divisional clerk, "Craigmoor," Godstone Road, Rotherham.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bradford.—Tramways Committee. Accepted:—
60 tons hand brake shoes (8s. 6d. per cwt.), and 60 tons track brake blocks (8s. 9d. per cwt.).—Yorkshire Repetition Castings Co., Ltd.
Electric tire heater (£174).—Equipment & Engineering Co., Ltd.
Electricity Committee. Accepted:—
Six 400-kVA indoor type and six 600-kVA outdoor type transformers.—Hackbridge Electric Construction Co., Ltd.
Six 400-kVA outdoor type transformers.—Bruce, Peebles and Co., Ltd.
Fourteen 600-kVA indoor type transformers.—English Electric Co., Ltd.
Recommended:—
Two 300-kVA indoor type rotary convertor transformers for Odsal sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
6,600-volt metal-clad switchgear for Valley Road power station.—A. Reyrolle & Co., Ltd.

Carlisle.—Electricity Committee. Accepted:—
Cables.—Metropolitan Electric Cable & Construction Co.; British Insulated Cables, Ltd.; Macintosh Cable Co., Ltd.
Plant for new power station and James Street sub-station. Accepted:—
Circulating water screens (£2,893).—Blakeborough and Sons, Ltd.
Two 8,000 kVA transformers, voltage ratio 11,500/3,300 (£5,370).—English Electric Co., Ltd.
One turbo feed pump (£575).—G. & J. Weir, Ltd.
3,300-volt switchgear equipment: Feeder equipment (£2,092); transformer equipment (£1,359).—British Thomson-Houston Co., Ltd.
Switchgear for auxiliary turbine (£810).—British Thomson-Houston Co., Ltd.
Switchgear for rotary convertor (£312).—Bertram Thomas, Ltd.
One 22-in. V.S. circulating pump equipment: Pump and equipment (£915); oil catchers (£18).—Worthington-Simpson, Ltd.
One 1,000-kW rotary convertor (£1,877).—Harland Engineering Co., Ltd.

Bedford.—Electricity Committee. Recommended:—
Overhead cable (£2,404).—R. M. Russell.
Main line to Wootton Pillinge (£1,329).—Pirelli-General Cable Works, Ltd.

Dumfries.—Town Council. Accepted:—
Turbo-alternator plant (£7,913).—Brush Electrical Engineering Co., Ltd.

Glasgow.—Tramways Committee. Accepted:—
Motors for saw mill machinery.—Electric Construction Co., Ltd.
Renewal of battery at Pinkston.—Tudor Accumulator Co., Ltd.
Recommended:—
Copper trolley wire (£1,260).—Felten & Guilleaume, Germany, per W. F. Dennis & Co. (Lowest British tender was £1,372).

London. — Islington. — Cleansing Committee. Recommended:—
Replacement of batteries in two electric vehicles (£409).—Chloride Electrical Storage Co., Ltd.
St. Marylebone.—Electricity Supply Committee. Recommended:—
Supply of cables for 12 months.—British Insulated Cables, Ltd.; Enfield Cable Works, Ltd.; Callender's Cable and Construction Co., Ltd.; Pirelli-General Cable Works, Ltd.
Renewal of battery at Blandford Street sub-station (approx. £2,000).—Tudor Accumulator Co., Ltd.
Enclosing the 3,000-kW convertor set (£585).—General Electric Co., Ltd.

Spalding.—Urban Council. Accepted:—
500-kVA step-up transformer (£279), and kiosks (£827).—Crompton Parkinson, Ltd.
Cable (£479).—Pirelli-General Cable Works, Ltd.

Forthcoming Events.

Physical Society.—Friday, May 24th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Institution of Electrical Engineers (Western Centre).—Cheltenham. May 24th to May 27th. Summer meeting.
June 11th-22nd. Summer meeting in France.

Association of Ex-Siemens' Men.—Wednesday, May 29th. Hotel Cecil. Dinner.

Incorporated Municipal Electrical Association.—June 3rd-8th. Torquay. Annual convention.

E.H.P. Conference.—Paris, June 6th to 15th.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Autex-Reel cord absorber (American; name of British agent wanted).
Phœnix washer.

Notes.

Electricity Output in the U.S.A. in 1927.

The total output of electricity reported by electric light and power plants in the United States for 1927 has recently been given by the Bureau of the Census as 74,654,531,374 kWh, an increase of 85.3 per cent. over the electricity generated in 1922, as determined in the preceding quinquennial census of electrical industries. The generator capacity is reported to have increased during the same period by 80.3 per cent., being 25,802,530 kW in 1927. Marked increases were shown also for the h.p. of steam turbines, internal-combustion engines, and hydro-electric turbines in use as prime movers. Municipal establishments decreased in the 5-year period from 2,581 to 2,192, or by 15.1 per cent., owing, it is explained, to the abandonment of municipal generating systems and the acquisition of distributing lines by commercial systems. Centralisation of ownership or control and the absorption of independent generating stations accompanying the extension of transmission lines explain the decrease of 43.4 per cent. in the number of commercial establishments, which were 2,135 in 1927, as compared with 3,774 in 1922.

Industrial Electric Heating.

Mr. R. Alan S. Thwaites, when recently addressing the North Midland Section of the British Electrical Development Association, said that it was often assumed, because even the most efficient existing electricity generating station utilising steam only converted about 25 per cent. of the heat in the fuel into electrical energy, that therefore the use of electricity for industrial heating purposes could have only a limited field of application. Such an assumption had no regard to various factors which were definitely to the advantage of electricity, the efficiency of utilisation of which was far higher than with any other form of heating, reaching in many cases well over 90 per cent. In the case of an electric furnace it paid to spend money on extra brickwork and heat-insulating material to keep down the losses to a minimum, and that was one reason why electric furnaces were comparatively expensive. A glass-annealing lehr consisted of a chamber 50 ft. or more in length, in one end of which hot glass articles were inserted, and they travelled slowly through the furnace during the period of a few hours, leaving the other end in a cold condition. Such a lehr was usually heated by gas, but recently an experimental electrically-heated lehr was constructed. Considerable attention had been given to heat insulation, and when put into use it was found that no electric current was required, as the heat put into the furnace in the glass articles was quite sufficient to balance the radiation losses. That might be regarded as a limiting case. There were thus a series of applications, starting with the exceptional case in which (given sufficient heat insulation) the process might be carried out without heat being artificially provided, and working progressively through stages in which the aspect of heat retention became less and less important, to the other extreme in which the main object was to get the heat into a metal reasonably quickly without any necessity for retaining the temperature reached for any appreciable length of time. Regarded purely from a thermal point of view, the commercial possibilities of electric heating were a maximum for the classes of process first referred to, and became progressively less favourable down the list. While practically all heating processes could be done electrically, there were many for which it would at the present time be unsound to advocate electric heating. Experience, both in this country and America, made it clear that there was no necessity for cutting the price to ribbons in order to satisfy consumers, so long as attempts were not made to cope with impossible conditions. In districts where tariffs for power load were reasonably low similar tariffs were usually satisfactory for heating purposes. As an example, the usual price of electricity for brass melting appeared to be between 0.5d. and 0.6d. per kWh. The potential load to be obtained by the application of electricity to industrial heating purposes was enormous.

The Swiss Rupperswil Sub-station.

Owing to the good results obtained with outdoor sub-stations, the Swiss Federal Railways now build practically all their sub-stations of the outdoor type. A typical installation of this description is at Rupperswil, which is the centre of distribution of power for the railway system in Northern Switerland; it serves to step-down the pressure of the incoming single-phase supply at 16⅔ cycles from 132,000 to 66,000 volts. The equipment comprises at present three 9,000-kVA transformers, but provision has been made for three further sets, bringing up the capacity to 54,000 kVA. The sub-station is provided with two busbar systems on the 132,000-volt and on the 66,000-volt sides, corresponding to the two incoming 132,000-volt lines. Both busbar systems are subdivided by means of isolating switches into three sections, each intended for two transformers. The circuit breakers for 132,000 volts, as well as for 66,000 volts, are made up of single-pole units coupled together, and arranged for remote control from the service building. The isolating switches are provided with horn-type arcing contacts and are so designed as to permit of the disconnection of transformers and lines on light load. The neutral point of transformers is connected direct to earth without the insertion of resistance on the 132,000-volt side, while on the 66,000-volt side the transformers are earthed through a resistance of 6,600 ohms. The installation has been entirely equipped by the Oerlikon Company and is fully described in Bulletin No. 92.

A Panhard-Oerlikon 2-ton Electric Lorry.

The Panhard-Levassor Co., of Ivry, Paris, France, has lately added to its range of productions a 2-ton electric lorry, the details of which have been worked out in conjunction with the Swiss electrical Société Oerlikon. The motor is of the series, tetrapolar type, spring-mounted at the rear of the chassis, a pinion on its shaft engaging with a crown wheel surrounding the differential on the rear axle. The power is supplied by a battery of 40 Dinin accumulators of a capacity of about 400 amp.-hours. The cells are divided into two groups and carried in two trays below the centre of the chassis, each tray being provided with four small wheels and so hung that it can readily be lowered to the ground and wheeled out of position when it is necessary to remove the battery for charging or other purposes. The controller is located under a small bonnet at the front of the vehicle; the various speeds are obtained by means of a pedal which is so arranged that when foot pressure is released the controller is automatically brought into the neutral position. The driver has also at his command a pedal and a hand lever actuating brakes on all four road wheels, and another hand lever controlling the reverse motion. The vehicle has a track of 5 ft. 2½ in., a wheel base of 9 ft. 9 in., and an overall length of 14 ft. 9 in., the body space behind the driver's seat being 13 ft. 1 in. in length. The detachable steel disk wheels are shod with 895 by 135 mm. tires. In running order the vehicle weighs 5 tons, of which 24 cwt. is the weight of the batteries. The Panhard Co. states that the electric lorry can cover distances of over 50 miles on one charge at speeds equal to those attained by petrol vehicles of similar capacity.

Chemical Works Rules.

A new and important activity of the Association of British Chemical Manufacturers is the issue of Model Safety Rules for use in chemical works. There will ultimately be two parts: *Part* 1—Model Rules in concise form, and *Part* 2—an explanation of the rules, fortified with examples of safety measures gathered from the accumulated experience of the industry and the Factory Branch of the Home Office. The safety matter is intended to supplement that contained in the Chemical Works Regulations, 1922, and to cover all chemical manufacture except authorised explosives, which are subject to special statutory rules. Compilation is being undertaken by the Works Technical Committee of the Association, under the chairmanship of Dr. E. F. Armstrong, on which are represented some of the largest manufacturing interests in the industry. At present the rules are only in provisional form, and are being circulated to members of the Association for inspection and criticism.

Electric Lamp Invention.

Referring to the paragraph under the above heading on page 795 of our issue of May 3rd, we are informed by Mr. A. A. Campbell Swinton that since he made the suggestions, he has found, through the courtesy of Mr. Lane Fox Pitt himself, who lent him a copy of his patent No. 3,968 of October 9th, 1878, that he was not only the first patentee of electricity distribution at constant potential, with everything in parallel, but that he was also, in the same specification, the first to patent what is now known as the gasfilled metal-filament lamp, his patent being prior to any lamp patent of Swan, and before even Edison's British patent for a platinum-wire lamp, which is dated the 23rd of the same month and year. No doubt modern lamps of this character use filaments of tungsten, and are filled with argon gas, while Mr. Lane Fox Pitt used a platinum-iridium alloy for his filament and nitrogen for his gas. In his time, however, neither tungsten in the form of wire, nor argon in any form, was known, and in his patent specification Mr. Lane Fox Pitt was careful to say specifically: "In order to prevent the deterioration of the material when incandescent, I sometimes surround it with an atmosphere of nitrogen gas," just as in modern lamps argon is introduced to prevent the deterioration (probably evaporation) of the tungsten. No doubt tungsten is a better substance than platinum-iridium to use as a filament, as being able to stand higher temperatures, while no doubt argon, as a more suitable gas, is better than nitrogen; but in both cases the principle involved is exactly the same, namely, the use of a filament with the highest possible melting point, and the prevention of the evaporation of the hot filament by counter bombardment by a neutral gas.

International Dam Construction Commission.

As a result of a movement started at the World Power Conference in Basle, Switzerland, in 1926, an International Dam Construction Committee has recently been organised, the object of which is the study of all technical questions in connection with the construction of large dams. The headquarters of the new Commission, on which twenty countries are so far represented, are in Paris. Signor Ponti, president of the Union of Italian Electricity Producers, has been elected the first president of the Executive Committee of the new body.

Electricity in Rice Cultivation.

Experiments have been going on in China for some little time now in connection with the application of electric power to rice growing, and so much success has already been achieved that projects are being mooted for its intensive exploitation. One of the essentials in rice growing is water, and in many places irrigation by natural means is difficult and even impossible. On several farms pumping by electricity is now being carried on, motor-operated pumps of up to 20 h.p. capacity having been installed for this purpose. The Foochow Electric Co. is not only supplying the electricity in the neighbourhood of that city, but also wiring the farms and installing the pumps. The charge for energy is comparatively small and the water can be well controlled, promoting the growth of the plant and bringing it to maturity without risk of reverse from the moisture standpoint. It ensures a second crop within the year in places where only one crop can be grown under natural, or manual, conditions. Proposals are now being made to run an overhead network of conductors over the rice swamps, to see whether the increased yield secured in experimental work by this course can also be secured on a commercial scale.

Street Escalators in France.

Escalators are now very generally used in connection with the tube railways in London, and are steadily replacing the lifts hitherto employed. It has, however, remained for France to install the first escalator in a public street, one having recently been completed in Havre to connect the low and high parts of the port. The escalator has a horizontal length of about 164 yards and an incline of approximately 14 in. per yard. It is operated by three synchronous electric motors of 10, 45, and 140 h.p.; the first is used to move the escalators slowly when repairs are necessary, the others are brought into use at different periods of the day, according to the traffic. The necessary power is supplied at 5,000 V, and is stepped down to 200 V by means of two 80-kW transformers.

Large D.C. Generators.

The Swiss Oerlikon Co. is making eight direct-current generators of 6,000 kW, which are designed to furnish 12,000 amperes at from 470 to 520 volts and a speed of 250 r.p.m. They will be driven by water turbines and must withstand an overspeed of 480 r.p.m. The direct current generated by them will be used by the Norsk Hydro-ammonia Works in Norway for the production of hydrogen by the electrolysis of water.

Local Society.

The Salford Technical and Engineering Association visited the Henry Simon (Engineering Works), Ltd., at Cheadle Heath on May 11th. The annual picnic tea will be held on June 15th at Alton Towers.

An Italian Science Exhibition.

The Historical Exhibition of Italian Science recently opened by King Victor Emmanuel covers a wide range, and has taken five years to prepare. Its object is to illustrate the wealth of scientific material existing all over Italy and to prove that many of the wonders of applied science owe their origin to Italian genius. In the Florence section are the thermometer invented by Galileo in 1602; his pendulum and the famous little telescope which he invented at Venice in 1609 and with which he discovered Jupiter's moons. The Bologna section contains records of Galvani's experiments in animal magnetism. The Ministry of Communications exhibit starts with the germ of modern electricity, Volta's "pile," and follows with all the developments of telegraphy and telephony that have since taken place, including the pantograph for the telegraphic transmission of pictures invented in 1856 by Giovanni Caselli.

A New Direction-finder.

Mr. William Dubilier, well-known in the American wireless industry, arrived in London on May 17th from New York, bringing with him a new type of direction-finder for aeroplanes. It was invented by Mr. Warren S. Eaton, an aviator, for whom the Dubilier Condenser Corporation is building 30 instruments, for prolonged tests by the United States Government. Mr. Dubilier has brought the original instrument with him, and is to show it to the Air Ministry, says the *Evening News*. It works like a compass, except that instead of pointing north, it points to whatever place one may set it. In another form it can be used for piloting ships along tortuous channels, in dense fog, at speed. The instrument is quite light; it weighs about 7 lb.

Appointments Vacant.

Principal engineering inspector for the Electricity Commission. Distribution engineer for the Burma Electric Supply Co., Ltd. Lady demonstrator for Scarborough Corporation Electricity Department. (See our advertisement pages to-day.)

Domestic Electric Water Heating.

In a paper under the above heading recently delivered by Mr. A. H. Langley, B.Eng., at the Liverpool University, are some interesting points of design in relation to the lagging of storage tanks and the placing of the heating elements. The most important feature in the design of the storage tank is the heat insulation, and the greatest care must be taken in the design of this part to ensure efficient working. The heat carried away through insulation depends not only on the conductivity of the solid material, but also on the way in which it is massed together. The rate of heat transmission is greatly reduced by the inclusion of air within the substance, as air is a very poor conductor and the surface of separation between the air and the solid substance offers considerable resistance to heat flow. It has been found by experiment that cotton wool or brown felt are the best insulators, with cork very nearly as good. The former harbour vermin, so that cork in the form or cork sheets, loose or cemented ground cork is generally preferred for insulation. The thickness of heat insulation depends on the air temperature in which the tank is placed, and also the temperature of the water. For tanks above 20 gallons capacity, a thickness of from 2 to 5 inches is usual for a water temperature of 190 deg. F., the larger figure referring to the smaller sizes, this being due to the higher inherent efficiency of the larger sizes. The top and bottom should have somewhat heavier insulation—particularly the top—where there is a continuous demand.

The heating element should be placed inside the tank and not in a separate circulator, and should be placed so that it does not impede the heated water in rising, *i.e.*, if of the flat double-bladed type, the flat face should be vertical. It should be as near the base of the tank as is practicable and should be removable without draining off the water. An auxiliary emergency heater may be placed at the top of the tank, so that a small quantity of hot water may be obtained immediately after the full contents of the tank have been drawn off. The inlet should be in the base of the tank and covered with a dome-shaped baffle to prevent the incoming cold water mixing with the hot water. By experiment it is found that in addition to efficient baffling the height of the tank should be at least twice the diameter. A thermometer is a very useful addition and it is advisable to place this about the middle of the tank.

A New Electric Brazing Furnace.

A new electric brazing furnace, which has been placed on the market by the General Electric Co. of America, utilises a gaseous atmosphere and is automatic in operation. The only labour involved in its operation is that necessary to keep the furnace supplied with work. The furnace is of the tunnel type, the furnace proper resting on supports above a roller conveyor. On this conveyor rests a row of trays on which the work is loaded. The furnace itself has openings at either end, in the bottom. It is heated at the entrance end and cooled at the other. Motor-operated elevators located beneath the furnace openings raise the trays of work into, and lower them from, the furnace. In operation, the trays are loaded on the roller conveyor which is completely covered with trays from end to end. The elevators at the beginning of the cycle are in the lower position. The heating units located at the entrance end of the furnace are arranged in several zones, the temperature of which is automatically controlled. There is a short neck just beyond the heating zone where some cooling takes place, while the remainder of the furnace is water jacketed for final cooling. This is so effective that the work, when it leaves, has a temperature below that at which oxidation will take place. The time for a complete cycle of operation is adjustable between certain limits. There is also a time interval between the completion of one motion and the beginning of a succeeding motion, and this is adjustable from ½ to 1½ seconds. The time between cycles is adjustable by means of a master timing relay which has a time setting adjustable between 5 seconds and 33 minutes. This range of time adjustment allows a wide range of variation in the product which is to be brazed.

A 200-mile Welded Pipe Line.

A pipe line 205 miles long, running from Jal, New Mexico, to El Paso, Texas, U.S.A., is now being electrically welded. This pipe line, 16 in. in diameter, will carry gas for the El Paso Utilities Co. The electric arc welding of the entire pipe line is being done under the direction of Messrs. Fred. Clark and F. G. Hoffman, and a total of 27 G.E.C. (America) welding equipments are in use, some mounted on Fordson tractors and driven by the tractor engine, and others mounted on trucks and trailers. The pipe, in 30-foot sections, is strung along the cleared right-of-way. Seven of the 30-foot lengths are then lined up, making a section approximately 200 feet long. One welding crew fixes the sections temporarily in position by tack welding and another completes the welds.

An Automatic School-lighting Switch.

A small automatic electrical device has been developed by the research engineers of the General Electric Co. of America for automatically switching on and off electric light in schools when necessary. The device consists of a small box, about the size of an ordinary radio receiving set. On one end is a lens, which allows light from the outside to fall upon a photo-electric tube, which is set for a certain degree of daylight intensity, and whenever the light from outside falls below that mark the "electric eye" causes a small relay to switch on the electric lamps in the school room. This instrument, placed near an outside window of the school room, can be adjusted easily to any degree of light intensity desired. An automatic time clock disconnects the apparatus during the hours when school is not in session, thus preventing the light being switched on automatically at night.

Institution Notes.

Institution of Electrical Engineers.

WESTERN CENTRE.—The summer meeting is being held at Cheltenham from May 24th to 27th. This evening the annual general meeting and declaration of ballot for the 1929-30 Committee vacancies was to take place at the Queen's Hotel, and was to be followed by dinner and a concert, by invitation of the Mayor, Ald. C. H. Margrett, O.B.E., J.P., and Coun. James Moore, chairman of the Electricity Committee. To-morrow, Saturday, the party will drive by motor coach to Cirencester, Bibury (where a trout farm will be inspected) and Chedworth (where a fine example of Roman villa will be seen); thence to the old town of Burford, where luncheon will be served at the "Cotswold Gateway" Hotel. The party will then proceed *via* Bourton-on-the-Water, Lower Slaughter and Moreton-in-Marsh to Broadway, where tea will be provided by the Shropshire, Worcestershire and Staffordshire Power Co. The return to Cheltenham will be *via* Stanway,

and *en route* the company's sub-station at Hester's Way, which transforms Cheltenham's bulk supply from 66,000 to 11,000 V, will be inspected. The total distance of the tour is about 94 miles. On Saturday evening the Western Centre dinner will be held at Cheltenham. On Sunday afternoon the past-chairmen's golf cup will be competed for on the Lilleybrook course, and tea will be provided by the courtesy of Mr. J. Marshall. On Monday the Gloucester Wagon Works will be inspected.

SCOTTISH CENTRE.—Members paid their annual visit to Dundee on April 26th, 1929, and had luncheon in the Queen's Hotel. In the evening the seventh ordinary meeting of the session was held; Mr. D. S. Munro, chairman of the Scottish Centre, presided, and there was a good attendance. Two papers were read and discussed. On April 27th there was an excursion by road from Dundee to Elie, *via* St. Andrew's and the Fifeshire coast. Luncheon and tea were served in the Marine Hotel, Elie, and time was allowed for a round at golf. The return journey was made *via* Cupar.

SOUTH MIDLAND CENTRE.—A summer meeting has been arranged to take place at the Avonmouth docks of the Port of Bristol on July 2nd. Charabancs will meet the Birmingham train at Bristol and convey the party to Avonmouth along the bank of the River Avon, and the undermentioned equipment will be inspected at the docks: e.h.p. and l.p. electrical gear at the Royal Edward Dock, motor-driven grain machinery, cold-storage equipment, new intake machinery, and large squirrel-cage motors (direct switching). Tea will be provided by the Port of Bristol Authority, and will be followed by a drive to the Somerset seaside resort of Clevedon.

Institute of Metals.

A large attendance is promised at the forthcoming German meeting of the Institute of Metals, to be held in Düsseldorf from September 9th to 12th. It will be not only the first meeting of the Institute to take place in Germany, but will also constitute the first gathering of metallurgists and engineers to take place in Germany since 1914. The Conference is to be held by invitation of the Verein Deutscher Ingenieure and of the Deutsche Gesellschaft für Metallkunde. In addition to papers by members of many nationalities, there will take place visits to works as well as gatherings of a social character.

Institutions of Engineers and Shipbuilders.

At the joint summer meeting that the North-East Coast Institution of Engineers and Shipbuilders is holding with the Institution of Engineers and Shipbuilders in Scotland from July 2nd to 4th at Newcastle-upon-Tyne, the papers to be read will include one on "Developments in the Uses of Electricity" by Mr. R. P. Sloan, C.B.E. The Duke of Northumberland has placed the Guest Hall at Alnwick Castle at the disposal of the Institutions for luncheon, which will be taken there during a visit to places of interest in Northumberland, and Lord and Lady Armstrong have invited the members attending the meeting to take tea at Cragside, Rothbury, during the course of the tour.

Faraday Society.

The annual report of the Council for 1928 shows that during the year 44 new members were elected. There were 19 resignations and three deaths; the roll at the end of 1928 was 466 members and three students.

On November 9th the Society celebrated the 25th anniversary of its formation, which took place on June 30th, 1903.

Its financial position continued to improve during the past year. The income and expenditure account showed a balance of £541. Only as recently as 1926 was the Society first able to show a credit balance after the war; although on January 1st, 1928, there was an overdraft at the bank amounting to £188, it was cleared off, and a cash balance of £129 was carried forward to 1929.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. E. W. HILL, M.I.E.E., chief engineer of Aron Electricity Meter, Ltd., has been elected to fill the chairmanship of the Meter and Instrument Section of the Institution of Electrical Engineers, rendered vacant by the recent sudden death of Mr. G. D. Malcolm. The appointment runs until the end of the current session (September 30th next).

It is reported that Mr. W. A. VALENTINE, C.B.E., Controller of the London Telephone Service, is retiring at the end of this month after more than 40 years' connection with the National Telephone Co. and the General Post Office.

At a meeting last week of the Sheffield Special Sub-Committee which is dealing with the appointment of a successor to Mr. S. E. FEDDEN in the post of city electrical engineer it was decided to interview eight applicants.

Hammersmith Borough Council Establishment Committee recommends that, subject to the approval of the Minister of Health, a gratuity of £600 be made to the widow of the late Mr. FRANK HILL, in recognition of his services as borough electrical engineer.

Mr. C. B. FISHER, C.B.E., is to represent the Surveyors' Institution (of which he is president) at the conference called by the Electricity Commissioners to consider matters connected with the supply of electricity in rural areas.

The Board of Trade has appointed Mr. ANDREW AGNEW, C.B.E., of the Shell Transport and Trading Company, to be a member of the National Fuel and Power Committee, in the place of Sir John Cadman, K.C.M.G., who has resigned owing to pressure of other work.

Mr. W. JACKSON, M.Sc., lecturer in electrical engineering at the Bradford Municipal Technical College, has resigned, to take effect from August 5th.

Mr. A. HUGH SEABROOK, M.I.Mech.E., M.I.E.E., has resigned his directorship of, and severed his connection with, Overhead, Limited.

The Sutton Coldfield Town Council has increased the salary of Mr. T. BLOORE, electrical engineer, from £850 to £1,000 per annum.

The Bedford Corporation Electricity Committee has appointed Mr. J. R. BLAIKIE as constructional engineer in connection with the preparation of plans, specification, &c., for the erection of the proposed switch house, at a salary of £32 per month.

Mr. F. G. TICEHURST, A.M.I.E.E., of the Lancashire Dynamo and Motor Co., Ltd., will shortly take up an appointment on the staff of the British Electric Transformer Co., Ltd.

Mr. ARTHUR C. WATTS, of the Premier Electrical Co., Tunbridge Wells, has been elected chairman of the Sussex branch of the Electrical Contractors' Association.

The marriage of Mr. FRED E. HOOPER, electrical engineer, Bradford, and Miss Irene Harrison, West Melton, took place at West Melton on May 20th.

Mr. MAURICE SIMPSON, of Shildon (Co. Durham) has been appointed assistant mains engineer to the Luton Corporation Electricity Department.

Obituary.—MR. W. R. ROGERS.—The death has occurred of Mr. William R. Rogers, district engineer in Gateshead for the Newcastle-upon-Tyne Electric Supply Co., Ltd., by whom he had been employed for 23 years.

DR. L. LUCAS.—The death recently occurred in Berlin, at the age of 65 years, of Dr. Lorenz Lucas, the chief engineer of the Accumulatoren Fabrik Gesellschaft of that city and a leading German authority on secondary batteries.

MR. G. H. WRIGHT.—We learn with regret of the death, on May 15th, of Mr. George Henry Wright, secretary of the Birmingham Chamber of Commerce and of the Birmingham Section of the British Industries Fair. Mr. Wright, who was in his 56th year, had been seriously ill for some time.

MR. J. W. BARRASS.—The funeral of the late Mr. Joseph William Barrass, of Morecambe, took place at Torrisholme last week. Mr. Barrass had been manager of the Morecambe electricity sub-station for a considerable period, but was compelled to relinquish his position owing to poor health.

MR. C. R. C. HART.—Mr. C. R. C. Hart, chairman and managing director of the Dermatine Co., Ltd., passed away on May 7th. He had been associated with the company for over 36 years, being managing director from 1911 and chairman and managing director from 1926.

MR. J. A. H. HUNT.—We regret to learn of the death of Mr. J. A. Harry Hunt at Llandudno on May 7th. Mr. Hunt had been connected with the fittings firms bearing his name for the whole of his lifetime, although he had not been actively engaged in business for a number of years. The family has been continuously engaged in the fittings business for at least four generations, and a point of interest in this connection is that the six bearers at the funeral, drawn from the present employés of his firm, had served a total of 278 years. The business is being continued under the direction of Mr. J. C. B. Hunt, the deceased's only son.

Mr. A. GRAHAM.—The death took place on May 8th at Forest Hill, of Mr. Alfred Graham. He was 72 years of age.

MR. E. J. REID.—We regret to learn of the death, on the 17th inst., of Mr. E. J. Reid, late of Reid Brothers, Engineers, Ltd. The cremation was to have taken place at Golders Green on Wednesday last.

MR. M. J. DOWNING.—We learn with regret of the death of Mr. Michael Joseph Downing, mains superintendent of the Guildford Corporation Electricity Department. Mr. Downing was involved in a motor-cycle accident on May 16th while on duty. He was 40 years of age.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

R. S. Mackereth, Ltd.—Private company. Registered May 15th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, mechanical engineers and contractors, manufacturers of and dealers in wireless apparatus, &c. The directors are:—Alice Broadbent, "Briar Cliff," 77, Claremont Road, Wallasey, Ches. (permanent); R. S. Mackereth, 56, Rock Lane West, Rock Ferry, Ches., merchant (managing director). Registered office: 11, Lord Street, Liverpool.

Marco Refrigerators (1929), Ltd.—Registered as a public company May 14th. Capital, £200,000 in 1s. shares. Objects:—To acquire the business carried on by Marco Refrigerators, Ltd., and all or any of the assets, together with the trade mark "Marco," to adopt an agreement with the said company, R. A. Fulford and A. E. Leach, and to carry on the business of manufacturers of and dealers in refrigerators, ice cream freezers and coolers, cold storage and general warehousemen, mechanical, electrical, and general engineers, &c. The first directors are:—Sir Sven W. Hansen, Bt., M.B.E., "Belwethers," Cranleigh, Surrey; R. A. Fulford, Kenley House, Kenley, Surrey; A. E. Leach, "Camber," Norbury Hill, S.W.16. The last two are directors of the vendor company. Registered office: Manor Works, Streatham Vale, S.W.16.

British Power and Light Corporation (1929), Ltd.—Registered as a public company May 7th. Capital, £2,000,000 in £1 shares. Objects:—To acquire (1) not less than 90 per cent. of the issued share capital of the North Wales Power Co., Ltd., with a view thereto to enter into an agreement with Robert Benson & Co., Ltd.; and (2) not less than 90 per cent. of the respective share capitals of the East Suffolk Electricity Distribution Co., Ltd., the Trent Valley and High Peak Electricity Co., Ltd., the South Somerset and District Electricity Co., Ltd., the West Hampshire Electricity Co., Ltd., and the Ringwood Electric Supply Co., Ltd., with a view thereto to enter into an agreement with the Power Development Co., Ltd., to carry on the business of an electric light and power company in all its branches and that of electrical engineers and manufacturers and maintainers of plant for the generation, accumulation, transmission and supply of electrical energy for light, heat and power or otherwise, manufacturers of and dealers in plant and machinery, &c. Purchase consideration: £1,050,280, £2,280 in cash and £1,048,000 in shares. The vendors of property purchased or acquired, or proposed to be acquired are: Aluminium Corporation, Ltd., Buckingham Gate, S.W.1; K. M. Clark, Wellington House, Buckingham Gate, S.W.1; W. H. McAlpine, R. McAlpine (the younger), Sir Thomas M. McAlpine, and A. D. McAlpine, 50, Pall Mall, S.W.1; Robert Benson & Co., Ltd.; and the Power Development Co., Ltd. The first directors are:—H. A. Vernet, 24, Old Broad Street, E.C.2, merchant; E. de Stein, Pinners' Hall, Austin Friars, E.C.2; C. E. Benson, 24, Old Broad Street, E.C.2; G. W. Partridge, 25a, Cockspur Street, S.W.1, engineer; G. V. Twiss, 25, Victoria Street, S.W.1. Secretary: J. Rankin. Registered office: 27, Old Broad Street, E.C.2.

H. J. Poole, Ltd.—Private company. Registered May 13th. Capital, £500 in £1 shares. Objects:—to adopt an agreement with H. J. Poole, to carry on, develop and turn to account the agencies and invention referred to therein, to carry on all kinds of agency business and that of electrical and mechanical engineers, &c. The directors are:—H. J. Poole (chairman), 1, Warwick Dene, Ealing, W.5, engineer; G. J. Poole, 7, Western Gardens, Ealing, W.5, engineer. Registered office:—Aldwych House, Aldwych, W.C.2.

Alfred H. Hughes & Co., Ltd.—Private company. Registered May 13th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of importers, exporters and manufacturers of, agents for and dealers in apparatus and accessories for wireless telegraphy, telephony or television, or in connection with the generation, accumulation, supply, distribution and employment of electricity for all purposes, &c. The subscribers (each with one share) are:—A. H. Hughes, Mansion House, Old Whittington, near Chesterfield, importer; A. H. Spalton, 25, Wellington Street, Sheffield, electrical factor. The first directors are to be appointed by the subscribers. Solicitor: M. J. Whitehead, 131, Norfolk Street, Sheffield.

Official Returns of Electrical Companies.

Hendon Electric Lamp Co., Ltd.—H. Bell, 27, Pont Street, S.W.1, and 22, Bedford Row, W.C.1, was appointed receiver and manager on May 2nd, 1929, under powers contained in debenture dated December 21st, 1928.

Liskeard Gas and Electricity Co., Ltd.—Particulars filed of £6,000 debentures authorised March 28th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital (subject to £8,000 first debentures dated 1925), the amount of the present issue being £300.

Electro-Mechanical Brake Co., Ltd.—Mortgage on freehold premises known as Eagle Works, Moor Street, West Bromwich, with machinery, &c., dated April 29th, 1929, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Tyche, Ltd.—Satisfaction in full on May 1st, 1929, of debenture dated August 29th, 1927, securing £200.

Johnson Billington Electricity Meters, Ltd.—J. J. Ure, 11a, Hart Street, W.C., ceased to act as receiver or manager on May 7th, 1929.

Lewis Thomas & Sons, Ltd.—Capital, £2,000 in £1 shares. Return dated September 5th, 1928 (filed February 21st, 1929). 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges, £2,500.

Wrexham Motor and Electrical Engineering Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1928. 1,428 shares taken up. £1,428 paid. Mortgages and charges, nil.

Nordisk Electrical Power Co., Ltd.—Capital, £10,000 in £10 shares. Return dated December 31st, 1928 (filed March 11th, 1929). All shares taken up. £20 paid. £9,980 considered as paid. Mortgages and charges, nil.

C. B. King (Magnetos), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1928 (filed February 19th, 1929). All shares taken up. £1,000 paid. Mortgages and charges, nil.

Willett & Robinson, Ltd.—Capital, £7,000 in 3,000 "A" cumulative preference, 1,000 "B" cumulative preference, and 3,000 ordinary shares of £1 each. Return dated August 14th, 1928 (filed February 9th, 1929). 2,000 "A" preference and 2,000 ordinary shares taken up. £4,000 paid. Mortgages and charges, £390. Return of allotments, made up to February 8th, 1929, shows a further 150 preference and 150 ordinary shares allotted, payable in cash and fully called up.

Galliers (Wholesale), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1928 (filed March 25th, 1929). 100 shares taken up. £50 paid, £50 calls unpaid. Mortgages and charges, nil.

Albany Accumulators, Ltd.—Capital, £1,000 in £1 shares. Return dated September 21st, 1928 (filed April 8th, 1929). 206 shares taken up. £202 paid. £4 considered as paid. Mortgages and charges, nil.

Burgoyne Manufacturing Co., Ltd. (old company).—E. D. Hine, Abbey House, Victoria Street, Westminster, ceased to act as receiver or manager on March 31st, 1929.

Nuneaton Engineering Co., Ltd.—E. J. Patterson, Throgmorton House, 15, Copthall Avenue, E.C., was appointed receiver and manager by Order of Court, dated March 22nd, 1929.

Johnson & Tanner, Ltd.—Charge on premises at Worcester Park, Surrey, dated May 3rd, 1929, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £250.

Cleethorpes Radio Supply, Ltd.—Issue on May 1st, 1929, of £200 debentures, part of a series already registered.

Bower Electric (1926), Ltd.—Particulars filed on May 2nd by permission of the Court of £19,992 debentures authorised February 23rd, 1929, and covered by trust deed of same date, charged on certain neon electric tube signs comprised in hire agreements and the company's other assets, present and future, including uncalled capital, the amount of the present issue being £294. Trustees: J. de la Valette and H. G. Foice, 6, Austin Friars.

Forum & Co., Ltd.—Satisfaction in full on April 2nd, 1928, of debenture dated January 9th, 1926, securing £10,000 and premium of 6 per cent. (Notice filed May 7th, 1929).

Barrett & Morris, Ltd.—Capital, £100 in £1 shares. Return dated July 26th, 1928 (filed April 20th, 1929). All shares taken up. £2 paid. £98 considered as paid. Mortgages and charges, nil.

William Johnson & Co. (Sheffield), Ltd.—Capital, £2,500 in £1 shares. Return dated December, 31st, 1928 (filed April 20th, 1929). 2,025 shares taken up. £1,025 paid. £1,000 considered as paid. Mortgages and charges, nil.

Melville Production Co., Ltd.—Capital, £300 in £1 shares. Return dated December 28th, 1928 (filed April 12th, 1929). All shares taken up. £300 paid. Mortgages and charges, nil.

E. Goldston, Ltd.—Capital, £2,500 in 2,250 preferred ordinary shares of £1 each, and 5,000 founders' shares of 1s. each. Return dated July 11th, 1928 (filed March 23rd, 1929). 1,282 preferred ordinary and 5,000 founders' shares taken up. £200 paid on 200 preferred ordinary shares. £1,332 considered as paid on 1,082 preferred ordinary and 5,000 founders' shares. Mortgages and charges, nil.

Marshall Electrical Co., Ltd.—Capital, £3,000 in 2,300 preference and 700 ordinary shares of £1 each. Return dated March 30th, 1928 (filed April 2nd, 1929). 2,300 preference and 682 ordinary shares taken up. £2,302 paid. £680 considered as paid. Mortgages and charges, nil.

City Notes.

Oriental Telephone and Electric Co., Ltd.

The annual meeting was held on May 14th, Sir A. Henry McMahon (chairman) presiding. In presenting the report and accounts (*vide* Elec. Rev., May 10th, p. 842), the chairman said that the work of installing the new automatic exchange equipment at Singapore was well in hand, and the new exchange should be in full working order shortly after the close of this year. The increase in the number of new exchange lines had not been quite so marked this year as it was last, due mainly to adverse trade conditions. These, however, were passing, and the company could look forward to the renewed expansion of the Singapore branch. The Mauritius branch was the one weak spot in their field of operations. The new scale of charges fixed by the Government of Mauritius came into force last May, but met with a certain amount of hostility, and there was something in the nature of a boycott at the outset. As, however, people gradually realised that the new rate was both fair and equitable, a return to a more reasonable frame of mind by telephone users might be anticipated. After referring to the operations of the associated companies in Bombay, Bengal, Madras, Rangoon and Hong Kong, the chairman moved the adoption of the report, and the motion was carried.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register and they are thereby dissolved :—

Alphian Wireless, Ltd.
Auto-Electrics, Ltd.
British Glowlamp & Valve Co., Ltd.
Cambrian Electricity Supply Corporation, Ltd.
Diesel Erection and Repairs Co., Ltd.
Elco Electric Mfg. Co., Ltd.
Electric Coils, Ltd.
Electrical Insulating Composition Co., Ltd.
Electricity, Gas, Share, Debenture, Investment and Guarantee Trust, Ltd.
Essex Radio (Ilford), Ltd.
Headphones (Manchester), Ltd.
Lighting and Power Finance Corporation, Ltd.
London and South Wales Electrical Engineers, Ltd.
Luen Electrical Supplies, Ltd.
Magneto, Accumulator and Generator Services, Ltd.
Radio and Electrical Supplies (Bolton), Ltd.
Radio Appliances, Ltd.
Radio Engineering Co., Ltd.
Radio Experimental Co., Ltd.
Roddis Electric, Ltd.
Rubber Cables, Ltd.
Shaftesbury Wireless and Engineering Co., Ltd.
Spa Radio Co., Ltd.
Universal Moulded Insulators, Ltd.
Victor Radio, Ltd.
Vinco Wireless Co., Ltd.
Willesden Electric, Ltd.

Official Notice re Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary :—

Cogent Electrical Co., Ltd.
Sun Power Co. (Eastern Hemisphere), Ltd.

Nigerian Electricity Supply Corporation, Ltd.

Presiding at the recent statutory meeting, the chairman (the Hon. Lionel Holland) reviewed the results of the capital issue made last month and spoke of the present position and future prospects of the company. He said that the cost of fuel in Northern Nigeria increased working costs considerably and the tin-mining companies would be eager to take a supply of electricity from the company; there was no question of a demand existing for the power which the company would generate. They had entered into 15-year contracts with several of the leading mines to take the whole of the power generated up to 6,000 h.p. on mutually advantageous terms. It was anticipated that the financial results when the installation was in operation would make the participating rights of the preferred shares of substantial value. The plant was on order and constructional work was well advanced. The storage reservoir was expected to be completed by the end of March, 1931, but generation would commence before that. It was expected that next year's revenue would be sufficient to pay the fixed dividend on the preferred ordinary shares.

Lancashire Electric Light and Power Co., Ltd.

The report for the year ended March 31st last shows that the trading profit of the Parliamentary Company (the Lancashire Electric Power Co.) plus interest receivable, amounted to £238,512, to which is added £3,000 brought forward, making £241,515. Of this £13,927 has been appropriated towards income tax, £50,000 for depreciation, &c., and £3,186 carried forward, leaving a balance of £174,401, which has been paid to the Limited Company with other amounts, making a total of £187,063. The balance at credit of profit and loss account of the Limited Company is £150,885, and to this is added £3,110 brought forward, making £153,995. After meeting preference dividends, a dividend of 7½ per cent. is paid on the ordinary shares and £3,308 is carried forward. Good progress has been made with the erection of the Kearsley generating station and the first section will be brought into commission in the autumn of this year. The electrical energy generated or purchased increased from 202,668,129 to 237,279,437 kWh, and the maximum load rose from 92,700 to 104,400 h.p.

Anglo-American Telegraph Co., Ltd.

Presiding at the annual meeting on May 14th, Lord Cochrane (chairman) referred with regret to the death of Mr. R. H. Benson, a director, and said that his son, Major R. Benson, had been elected to fill the vacancy. The relationship of the company with the Western Union Co. continued to be harmonious, and that company had kept the cables in excellent condition. The past year had been one of great activity in the cable world, notably the great merger of wireless and cables. Wireless telegraphy would never entirely supersede cable telegraphy, and in support of that statement he pointed out that the cable receipts of the Western Union had increased during the past year, while the volume of traffic handled was greater than that of any other year. The report and accounts were adopted.

Cawnpore Electric Supply Corporation, Ltd.

The accounts of this company were reviewed in our issue of May 10th (p. 842). The annual meeting was held on May 14th, when Mr. J. G. B. Stone, the chairman, said that the electrical energy sold for lighting and fans increased by about 11 per cent., for power by 4 per cent., and public lighting and special contract supplies each showed an increase of 8 per cent. The maximum supply demanded rose by 12 per cent. The year under review had been one of great depression in the cotton trade, but they were nevertheless steadily increasing their connection among the various industries in Cawnpore, and as a result of last year's experience, they had been able to make reductions in the charges for power purposes. The demand upon their generating plant was approaching the limit, and they had now under consideration the extension of plant to provide for the anticipated increase in demand. The report and accounts were adopted.

Prospectus.

Marco Refrigerators (1929), *Ltd.*—Last week this company offered for public subscription 2,420,000 shares of 1s. each at par (£141,000) out of a total authorised capital of £200,000. The prospectus stated that applications for over 2,000,000 of these shares had already been received. The company has acquired the business of the manufacturers of "Marco" refrigerators, including an automatic electric model. The purchase consideration is the allotment of 1,080,000 shares as fully paid, and £6,000 in cash. It is estimated that the working capital available from the issue will be about £94,000. Further details of the concern appear in our "New Companies" section to-day.

Anglo-Portuguese Telephone Co., Ltd.

The directors have sent a circular to the holders of the ordinary and "A" ordinary shares offering them 113,012 new ordinary shares of £1 each at par. These will be allotted in the proportion of one new share for each five shares already held. The circular states that the issue is to provide for the

expansion of the company's business and that the present market price of the existing ordinary shares is about 25s. per share. The new shares will rank *pari passu* with the existing ordinary shares as from January 1st, 1929. The offer remains open until June 4th and holders of bearer shares are required to deposit their warrants with the company on or before May 27th in order to qualify for the offer. The Portuguese public are being offered 5,000 new shares; these will be offered in the first place to the company's subscribers.

Cable, Telephone and General Trust, Ltd.

Presiding at the annual meeting on May 10th, Sir Alexander Roger (chairman), in presenting the report and accounts, said that increased business had been transacted by means of short-term borrowing, and while it was not proposed at the present time to create any additional share capital, it was probable that further capital would be issued in the not far distant future. The company had sought to maintain a distribution of its interests over different kinds of securities in the various countries throughout the world. A firm foundation had been laid on which it could build, and it looked forward to the future with considerable confidence. He referred with regret to the death of Mr. J. Lee, a director. The report and accounts were adopted.

Simms Motor Units, Ltd.

Speaking at the recent annual meeting of the company, the chairman (Mr. F. R. Simms) said that their electrical service at home and overseas was efficient and highly appreciated. The Standard Insulator Co., Ltd., whose entire capital was held by the company, had proved an excellent investment. The increased demand was necessitating the extension of the works. The company's own new works, extending over 6½ acres, at East Finchley, had just been completed. Partly to finance this, 100,000 £1 6 per cent. preference shares were issued in February. They had formed a South African company, and intended to extend their successful branch policy over the entire British Empire, and possibly other overseas countries.

Siemens Bros. & Co., Ltd.

The directors' report for the past year shows that the profit again declined slightly—from £356,735 to £335,758. The ordinary dividend is, however, maintained at 7½ per cent. The amount carried forward is increased from £250,041 to £313,360. This is accounted for by the fact that for 1927 £7,560 was reserved for taxation and £93,200 was written off debenture discount. The report states that the company's turnover was well maintained during the year, and the falling-off in profits was due to an increased proportion of overseas business in which competition is more severe, leading to lower prices. Owing to the small demand for submarine cables that department of the Woolwich works was idle to a great extent. Meeting: May 27th.

Iron Trades Employers' Insurance Association, Ltd.

The report for the year ended December 31st last records a premium income of £685,543, to which are added interest, &c., £112,396, and a balance of £48,278 brought forward, making £846,217. Compensation and incidental expenses absorbed £505,697, and management expenses, &c., £83,267, leaving a balance of £257,253. Out of this it is proposed to return 20 per cent. of the Workmen's Compensation premium paid for 1928, together with a bonus of 12½ per cent. on which income-tax has already been paid. The report refers with regret to the death of Mr. W. Jackson, a director. At the annual meeting on May 9th the report and accounts were adopted.

The Cable-Wireless Merger.

Last week Cables & Wireless, Ltd., issued to the stock and shareholders of the three telegraph companies and the Marconi Co. full particulars of the terms upon which the exchange of shares is to take place. The broad principles of the scheme were set out in our issue of April 19th, p. 720. The offer remains open until June 28th, but the time can be extended until July 31st if necessary. The circular gives particulars of the directors of the merger company, showing their holdings in the constituent companies.

Last week the Dominion House of Commons, Canada, passed a Bill ratifying the agreement for the sale of the Pacific Cable and associated systems to the merger company.

Sphinx Electric, Ltd.

The statutory meeting was held on May 14th, when Sir A. C. T. Beck (chairman), who presided, said that the company's sales had shown a large advance. Their manufacturing programme included a greatly-increased output in readiness for the coming lamp season. The Quickfix Electrical Fittings Co., had made them sole distributors of its products in the British Isles, with an option on the world rights. Many important contracts had been received and an advanced stage had been reached in negotiations for the acquisition of a large provincial manufacturing house with a factory in Birmingham and branches in the most important industrial centres. Other developments were in contemplation.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to the officially quoted:—

Barcelona Traction, Light and Power Co., Ltd.—287,250 ordinary shares of $50 each, fully paid; 251,934 7 per cent. non-cumulative participating preference shares of $100 each, fully paid; and £1,677,060 5 per cent. first mortgage 50-year bonds within Nos. A1 to A127,500 and A174,501 to A320,000 (£20) and B1 to B25,550 (£100).

Enfield Cable Works, Ltd.—100,000 ordinary shares of £1 each fully paid, Nos. 250,001 to 350,000.

Barcelona Traction, Light and Power Co., Ltd.

The annual meeting was held in Toronto on May 16th. Mr. Miller Lash (vice-chairman), who acted as chairman, said that owing to the increased demand for power, the net consumption for the first four months of the current year showed an increase of 15 per cent. over the corresponding period of last year. The work on the San Lorenzo plant was progressing satisfactorily, but the unprecedented drought which had prevailed throughout Spain during the past year had reduced the company hydro-electric resources considerably, necessitating an unusual amount of steam production, with a consequent increase in the cost of operation. The report and accounts were adopted, and Sir Thomas White was elected to the board.

Telephone Co. of Pernambuco, Ltd.

The report for 1928 states that the period represents the first complete year's working of the automatic system. After charging the full amount of the interest on the 8 per cent. registered debentures there is a loss on revenue account of £5,063, from which is deducted a credit balance brought forward of £732, leaving a debit balance of £4,331. The first zone of toll line extensions was inaugurated in December, and work is progressing satisfactorily on the second zone. A majority of the company's shares having passed under American control, changes have been made in the directorate.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

The profit for the year ended December 31st, 1928, was £16,545, as compared with £26,842 in 1927. A balance of £781 brought forward, and £446 net repayment of income tax claimed are added, making £17,772. From this £7,000 is set aside for depreciation. The directors recommend a dividend of 6 per cent. on the ordinary shares, leaving £623 to be carried forward.

Lima Light, Power and Tramways Co.

The gross profit for the year ended December 31st, 1928, was £P164,910; to this is added £P269 brought forward, and after meeting bond interest and preference dividends, there remains £P79,591. It is proposed to place £P36,000 to amortisation of installations fund, 5 per cent. to reserve, 5 per cent. to directors, and to pay a dividend of 75 centavos per share on the ordinary shares (as for 1927), leaving £P1,063 carried forward.

National Electric Construction Co., Ltd.

The profit for the year ended December 31st last was £23,466, and after deducting debenture interest, &c., and adding £5,655 brought forward, there remains £23,605, which it is proposed to distribute as follows:—Special reserve, sundry debtors, £9,000; general reserve, £2,200; dividend of 10 per cent., less tax (as in 1927), £6,800; carried forward, £5,605.

Glenfield & Kennedy, Ltd.

The profit for the year ended March 31st last was £79,296, as against £43,505, to which was added £45,461 brought forward, making £124,757. Of this it is proposed to place £5,000 to the staff pension fund, and £20,000 to reserve. The dividend remains at 10 per cent., a final distribution of 6 per cent. being recommended, and £63,257 is carried forward.

Ransomes & Rapier, Ltd.

The directors report a net profit of £11,888 for 1928, against £2,111 for 1927. A final dividend on the ordinary shares of 3 per cent. is recommended, making 5 per cent for the year (free of tax).

Richard Johnson & Nephew, Ltd.

A dividend at the rate of 8 per cent. calculated from the date of calls to March 31st has been declared on the ordinary shares.

Hydro-Electric Securities Corporation.

An initial quarterly dividend of 25 cents per common share has been declared.

Adelaide Electric Supply Co., Ltd.

An interim ordinary dividend of 6 per cent. free of tax has been declared.

Melbourne Electric Supply Co., Ltd.

An interim dividend of 5 per cent. free of tax has been declared on the consolidated ordinary stock.

Austrian Companies.

The *Felten and Guilleaume Cable Works Co.* states that it was not possible in 1928 to maintain the level of the production in the previous year, although in general the works were sufficiently occupied. The net profits amount to 1,920,000 schillings (against 1,740,000 sch.), and the dividend is raised from 11 to 12 per cent.

The *Austrian Brown-Boveri Co.* reports an increase in the turnover in 1928. Among the notable orders were those received from the Russian trading representatives on the basis of guarantees given by the city of Vienna. Out of net profits of 974,000 sch. a dividend at the rate of 14 per cent. is being declared, as against 762,000 sch. and 12 per cent. in 1927.

The *A.E.G.-Union Electricity Co.*, Vienna, states that reserve was manifested by the industries in the allocation of orders in 1928, but the company was still engaged on contracts for the Federal Railways, the Vienna station, and various hydro-electric works. A dividend of 7 per cent. has been declared out of net profits of 550,000 sch., as compared with 6 per cent. in 1927.

German Companies.

The *Felten and Guilleaume Co.* states that activity in 1928 was satisfactory, although the orders placed by the Reich postal and railway authorities did not by a long way reach the level of former years. Abroad the company was still faced with severe foreign competition, although steps had been taken with regard to international understanding. The submarine telephone cable between Sweden and Finland was completed. The experience gained and the progress of technical work had rendered it possible for the directors to enter into negotiations concerning submarine telephone cable schemes. Including the German subsidiaries and the Austrian company, the total turnover last year amounted to 225 million marks, and the net profit amounted to 5,580,000 marks, as compared with 4,110,000 marks in 1927. The dividend is increased from 6 per cent. to 7½ per cent.

The *Company for Electrical Undertakings*, Berlin, reports that the growth in the supply of energy from the electricity works, which amounted to 27.5 per cent. in 1927, was only 13.5 per cent. in 1928, reflecting the decline in the general trend of German economic life. As the undertakings in which the company is interested are spread all over Germany, it is assumed that these figures can be treated as a fairly sure indication of the situation. The report records the sale at a good profit of the company's participation in the new shares in the Spanish-American Electricity Company and in a Belgian company. The accounts show net profits of 6,470,000 marks, as compared with 6,220,000 marks in 1927, and the dividend remains at 10 per cent.

The *Lloyd Dynamo Works Co., Bremen*, after providing for depreciation, reports a net profit of 12,000 marks, which is carried forward.

The *Electricity Co. (late Schuckert)*, Nuremberg, reports net profits of 6,523,000 marks for 1928, as compared with 4,637,000 marks in the preceding year. The dividend is raised from 8 per cent. to 11 per cent.

The *North German Sea Cable Works Co.*, of Nordenheim, a subsidiary of the Felten and Guilleaume Co., reports a net profit of 8,000 marks, which is carried forward.

The *Hartmann and Braun Co.* reports a decline in the net profits from 346,000 marks in 1927 to 267,000 marks last year, although the dividend remains at 10 per cent. The directors ascribe the less favourable results to increased salaries and wages, which were not met by a corresponding advance in sale prices.

French Companies.

The *Société des Téléphones Grammont* records profits of 3,139,000 fr. for 1928 (against 1,617,000 fr.). Two million fr. has been applied to depreciation. The share capital is to be increased by 18 million to 30 million fr. in connection with an agreement entered into with the German Berliner Telephone Co., which will enable the French company to embark upon new branches of the telephone industry.

The *Compagnie Générale d'Applications Electriques* records net profits of 453,000 fr. for 1928 and a dividend of 10 per cent. is being paid.

The *Société des Ateliers de Constructions Electriques de Delle* reports net profits of 949,000 fr. for 1928; a dividend of 90 fr. is declared on the fully-paid shares.

The *Compagnie des Entreprises Générales Electriques et Industrielles (G. Giraudon)* records net profits of 4,322,000 fr. for 1928, the dividend being 27.65 fr. per share.

The *Société des Forges et Ateliers de Constructions Electriques de Jeumont* recommends an increase in the dividend from 30 fr. per share to 32.50 fr. for last year.

The *Société de l'Electrification Industrielle* (late *Loustau, Petit et Cie*) reports net profits of 3,019,000 fr. for 1928. A dividend of 14 per cent. is being paid on the registered shares.

The *Compagnie Continentale Edison*, Paris, reports profits of 2,023,000 fr. for 1928 (against 1,880,000 fr.). The dividend is maintained at 8 per cent.

Stocks and Shares.

TUESDAY EVENING.

THE market in the shares of a certain number of provincial electricity supply companies continues to be lively and active, attracting a widening circle of public interest, while the erratic movements in prices offer scope for speculative dealings. A few of the shares in manufacturing companies are also animated—Associated Electricals being the leading feature. It can be said without fear of contradiction that the market for electricity supply shares and electrical equipment issues is one of the very few round the Stock Exchange which is not overborne by the proximity of the General Election. Interest in wireless and cable descriptions has died down to a noticeable extent, dealings in Marconis, for instance, being now considerably less in volume than was the case a month or so ago. New York attention is evidently at the back of the liveliness that characterises the electricity group. There has been a large demand for the up-to-date map, issued by a leading firm of Stock Exchange dealers, that shows in different colours the various areas of the groups which operate a large part of the country's electricity supply industry.

New Issues.

The issue of British Power & Light Corporation 1,600,000 shares of £1 each, received none too ardent a response from the public, underwriters being left with more than half the issue. The price fell to 1s. 3d. discount, at which there was a fair amount of support forthcoming. Lancashire Electric new shares, after being 1s. premium bid, reacted a few pence because of the falling-due of the call that made the shares fully paid. This seemed to restrain further buyers, and it would appear as though some of the stag brigade have not yet completed their sales. Clyde Valley new preferences are better at 13s. 6d. premium. Young Accumulator shares further drooped to 1s. 6d. discount. Demand for Egham and Staines shares, after the list for the new issue at 30s. had closed, has resulted in a rise to 37s. Gossip is busy with absorption possibilities in connection with this company. New issues are said to be in contemplation by several well-known provincial supply undertakings.

Electricity Supply Companies.

Excitement during the past few business days has run principally upon such shares as Northampton Electrics, Associated Electrical Industries, and, to a smaller extent, Metropolitan Electrics and County of London Electrics. The market as a whole, however, has enjoyed a considerable slice of public attention, though, on the intervention of the holidays, profit-taking became very obvious, Northampton, which had been up to 46s. 6d., reacting to 44s. County of London held most of their recent rise, on the expectation of an early issue of new shares at a bonus price. Metropolitans have gone back to 46s. 3d. The offer of 50s. for Shropshire "A" and "B" shares led to the vigorous buying of Northamptons which served to put up the price to the levels just mentioned, but, as soon as the support ceased, it appeared as though local people were selling their shares, and taking what must have been excellent profits. Midland Counties shed 1s. after their last week's advance of 4s.; Midland Electric Power Corporation put on 1s. 9d., advancing to 37s. 6d. Chelsea ordinary moved up to 26s. 6d. Other movements in this department have been confined to a few pence apiece. Atlas ordinary are 27s. 3d.

Cables and Wireless "Plan."

Cables & Wireless, Ltd., has issued a lengthy Plan and Deposit Agreement to holders of Marconi shares, Eastern Telegraph ordinary stock and Eastern Extension and Western Telegraph shares The Plan recapitulates statements the gist of which has been common knowledge for some time past. It contains the offer to proprietors of the ordinary share capital in the three cable companies, and of the ordinary and preference shares in Marconi's Wireless Telegraph Co., to exchange their present holdings for fully-paid shares in Cables and Wireless, Ltd., the capital of which is to be 53 million pounds sterling. To accept the offer, shareholders must deposit their certificates with the Bank of England and their holdings will become "assented" stock exchangeable in due course, after the plan becomes operative, for shares in Cables and Wireless, Ltd.

Waiting for Dividends.

The point upon which there is bound to be some little disappointment in the minds of cable shareholders, is that of dividend payments. For immemorial years, the ordinary holders in the Eastern group have been in the habit of receiving their dividends quarterly. Under the new proposals, those people who exchange will get the preference dividends half-yearly, the first one being split into two instalments, payable in July and September this year. But on the "A" and the "B" ordinary shares, no dividend can be declared before the accounts for the period ending December 31st, 1929, have been passed by shareholders in Cables & Wireless, Ltd., in general meeting to be held about the middle of 1930. It is clear, therefore, that shareholders will have to wait for over a year from now before they are paid any income on their

"A" and "B" shares. This looks like a serious disability, although closer examination will show that, as the preference dividends are to be met half-yearly, the time of waiting for a return on the ordinary shares is of no very serious importance.

Effect upon Share Values.

Eastern Telegraph ordinary stock has receded 2½ points to 277½. Eastern Extensions and Westerns remain at 28. Globe ordinary have risen to 29. The Marconi trio is ex dividend, the 10s. shares at 4⅛, the £1 at 4 13/16, and the preference at 4⅛. Canadian Marconis receded to 32s. 6d. Burndept Wireless are dull at 4s. 9d. Last week's gain of 20 points in International Telephone and Telegraph has been followed by a reaction of 14, leaving the price at 266. The company, through its subsidiary the International Standard Electric Corporation, has bought a substantial interest in Ferdinand Schuchhardt's Berlin telephone and telegraph works with the object of obtaining, *inter alia*, a foothold in Germany's national telephone, telegraph and radio business. American Telephone and Telegraph is 10 points lower at 220. The Anglo-Portuguese Telephone is issuing, as rights, one new share at par for every five old shares held. Oriental Telephones are up to 60s.

Lower Profits.

British Electric Transformer preference have fallen to 13s. 9d. on the reduction in the year's profit to £14,700, as compared with £53,700 in the previous twelvemonth. Payment of the last half-year's preference dividend has been postponed. Price-cutting is held largely to blame for the shrinkage in profits. The company has orders in hand that will provide work for the next two or three years. Siemens profits are £21,000 down, against those of 1927, at £335,750. The dividend on the ordinary shares is maintained at 7½ per cent. less tax. At 27s. 6d. the price shows no change on the week. There is on offer a fair line of the company's 10 per cent. cumulative preference shares at 32s. 6d., which at this price yield £6 3s. per cent. on the money. Dividends are due in January and July, and require £55,000 to meet the annual service. On last year's profits of £335,700 the dividend is therefore covered six times over.

Equipment and Manufacturing.

Interest in General Electrics has been almost eclipsed by that which is now aroused over Associated Electrical Industries. The prices of the two shares met, at 55s., General Electrics being ½ down, Associated 10s. up, in their reaching of the common level. Henleys are a good market, in spite of the nominal quotation showing no change at 6 1/16. British Aluminium picked up to 51s. 3d. Brush ordinary at 28s. 9d. hold their modest improvement. This price still includes the dividend of 10 per cent. less tax, almost 1s. 7d. per share net, allowing for which Brush ordinary return £7 8s. per cent. on the money. British Insulated have gained 2s. 6d. at 3¾. At last week's meeting of the Anglo-American Telegraph Company, the chairman claimed that the wireless telegraph would never entirely supersede cable telegraphy. He mentioned that the Western Union Company, which controls the Anglo-American Telegraph, had kept the cables in excellent condition.

"Dollar" Stocks.

Hydro-Electric Securities Corporation rose 1¾ to 36¼, upon declaration of a maiden dividend of 25 cents per share, described as a quarterly distribution. This company, and the International Holdings, were the two upon whose shares especial interest focused at the time of Mr. Alfred Lowenstein's death. The prices of the shares in both these companies were the subject of a collapse from the effects of which they have never properly recovered. International Holdings stand at 8¼. The company has declared a half-yearly dividend of 10 cents per share. Brazilian Tractions in this section picked up to 56¼: the preferred gained several points at 185. Mexican Light and Power common and preferred are heavy. Pennsylvania Water and Power have again given way, being now 85¼. Montreal Light and Power moved upwards, to 108. Barcelona Tractions are 2¼ down at 50: the chairman in a recent speech spoke optimistically of the prospects for the current year. The Barcelona Exhibition opened last Sunday. The unprecedented drought in Spain last year reduced considerably the company's hydraulic resources, and thereby increased the cost of operations.

Miscellaneous.

Whitsun's lovely weather led to a little inquiry for Home Railways, in which the Undergrounds were included. Metropolitan consolidated rose 1 to 61. Undergrounds are steady. The London tramway issues retain their previous firmness, and attract increasing business. Better tendencies are observable, also, amongst iron and steel shares, Vickers, for instance, being 11s. 1½d. Engineering descriptions are firm. The price of rubber made a valiant effort to attain 1s. per lb., and all but achieved it. The share market developed a mild hopefulness. Power Corporation of Canada shares are 4 points down, at 103½. Kalgoorlie Electric Power and Lighting ordinary shares are 10s.: the dividend of 6 per cent. is the same as that of a year ago, but the profit of £16,540 is about £10,000 lower. British Electric Traction preference is better at 129: the deferred stock holds its last week's advance to the spectacular figure of £1,000.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price May 21 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	65/9	—	4 11 4
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	26/6	+6d.	5 5 8
City of London	1	10	10	38/3	—	4 4 6
do. do. 6% Pref....	1	6	6	23/-	—	5 4 4
Clyde Valley	1		8	32/6	—	... ...
County of London	1	7½	10	53/-	—6d.	3 12 9
do. do. 6% Pref....	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	28/-	—	5 12 0
Elec. Supply Corporation	1	11	—	57/6	+3d.	3 13 6
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 6
London Electric	1	8½	9	27/6	—	5 1 10
Metropolitan	1	9	9	2 5/16	—1/16	3 18 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	33/-	—1/-	3 13 9
Mid. Elec. Power	1	15	8	1⅝	+1/6	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	26/3	—	4 11 5
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	32/-	—	5 0 0
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	43/8	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

Home Rails.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,	3	3½	61	+1	5 14 8
do. District	,,	4	5	71½	—	6 10 9
Underground Electric	£1	5	7	24/-	—	5 13 10
do. do. Income ...	Bonds	6	6	114	—	5 5 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	109½	—	5 17 1
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	2⅜	—	5 18 0
Eastern Extension	10	10	10	28	—	*3 11 5
Eastern Tel. Ord.	Stock	10	10	277½	—2½	*3 12 3
Globe Tel. and T. Ord.	10	10	10	29	+⅛	*3 9 0
do. do. Pref.	10	6	6	11⅜	—	5 5 6
Great Northern Tel.	10	20	—	33	—	... ...
Indo-European	25	10	10	52½	—	*4 11 9
Marconi	10/-	10	20	4⅛xd	—1/16	... ...
Marconi-Marine	1	12½	15	3¼	—	4 12 4
Oriental Telephone Ord.	1	12	12	3	+1/16	... ...
Western Telegraph	10	10	10	28	—	3 11 5

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅜	—	7 11 8
do. do. 2nd Pref. ...	5	6	6	3⅜	—1/16	8 0 0
do. do. 5% Deb. ...	Stock	5	5	76½	+2	6 10 9
British Electric Traction Def. Ord.	,,	5	5	1000	—	... ...
do. do. Pref. Ord.	,,	8	8	129	+1	6 4 0
Brazil Traction	100	7	8	56½	+1	3 10 9
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	91½	—1	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	13/-	—	... ...
London United Tram Deb. ...	Stock	4	4	64	—	6 9 1
Mexico Trams, 5% Bonds	—	5	5	72½	+1	6 19 10
Mexican Light Common	100	Nil	Nil	72½	—5	... ...
do. 7% Pref.	100	7	7	79½	—2	9 18 2
do. 1st Bonds	—	5	5	70½	—	6 10 9
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		1926.	1927.			
Assoc. Elec. Ord.	1	—	6	55/-xd	+1/-	2 13 4
Babcock & Wilcox	1	18	15	64/6	—	*4 13 0
British Aluminium Ord.	1	10	10	51/3	+9d.	*3 18 9
British Elec. Transformer Pref. ...	1	7	7	13/9	—1/16	9 6 8
British Insulated Ord.	1	15	15	3¾	+⅛	4 0 0
Brush Ord.	1	10	10	28/9	—	7 8 0
Callenders	1	15	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 3
do. 5% Deb.	Stock	5	5	80½	—	6 15 7
Electric Construction	1	7½	7½	18/9	—	8 0 0
Enfield Cable Ord.	1	20	20	4¼	—	4 14 1
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	8/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	10	22	—⅛	3 12 9
Henley...	1	25	25	6 1/16	—	4 1 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	36/3	—	5 10 —
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	24½	—	*4 19 8

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during April.

THE Board of Trade Returns of imports and exports during April show that it was a good month so far as electrical products were concerned. The export total of £1,674,234 was the highest reached since March, 1928, and represented an increase of over £300,000 upon the preceding month's figure. An examination of the items reveals that this increase was very largely due to greater shipments of wires and cables. Insulated wires and cables were £56,799 up, non-submarine telegraph wires and cables rose by £105,043, and submarine cable by £18,650, together accounting for an advance of £180,492. A number of the other items showed considerable rises, however, particularly telegraph and telephone instruments and apparatus (£48,441), unenumerated machinery (£35,495) and unenumerated goods and apparatus (£31,211). It will be noticed that the "unenumerated" items represent over a third of the total. There were only three decreases, that in the exports of railway and tramway motors (£36,383) being the only one of any size. As compared with the corresponding month of 1928 the position was very similar. The same items show the greatest advances, the largest being one of £70,043 in unenumerated goods and apparatus. The net rise in the machinery section was only about £9,000, the rise in unenumerated machinery being offset by falls in the two specified items. There were three other smaller decreases. As a consequence of the rise in exports during April the total for the completed portion of the year is now only £79,717 below that for the corresponding period of 1928. It should be pointed out that Easter fell in April last year and partly in March this year and this, no doubt, accounts for a great deal of the increases in the two comparisons.

So far as imports were concerned there was a fall of £28,787 as compared with the March total. This was attributable mainly to a decrease of £25,725 in glow lamp imports, which no doubt marks the end of the lighting season. Meters and instruments, and telegraph and telephone apparatus also declined. Against these, there were rises in the imports of the two classes of cables and in unenumerated goods and apparatus. As compared with April, 1928, there was an increase of £89,225 in imports due to larger purchases of telegraph and telephone apparatus, insulated wires and cables, unenumerated goods, &c., which were only partly offset by decreased imports of meters and instruments, arc lamps and non-submarine telegraph and telephone cables. For the first four months of the year the increase above the total for January—April, 1928, stands at £199,385.

There was a fairly general increase in the re-export section as compared with March, although the total was smaller than that of April, 1928.

The following table analyses our exports of electrical machinery during April and compares them with the corresponding month of last year :—

Destination.	April, 1928.	April, 1929.	Inc. or Dec.
	£	£	£
European countries ...	86,167	93,891	+ 7,724
Japan	4,832	10,764	+ 5,932
South America ...	34,112	28,847	− 5,265
South Africa	47,043	60,506	+13,463
British India	87,016	146,174	+59,158
Australia	75,337	71,761	− 3,576
New Zealand	38,878	15,242	−23,636
Canada	15,813	18,841	+ 3,028
Other countries ...	112,061	64,318	−47,743
Totals ...	£501,259	£510,344	+£9,085

The increases in exports to Canada, Japan, South Africa and India are satisfactory and it is noteworthy that the exports to the European Continent are being kept up. The decline in New Zealand's purchases probably reflects the slackening-off of hydro-electric development, but this is only a passing phase, for the Dominion is stated to be in a very prosperous condition. Assuming "other countries" to be non-Empire markets, the British Dominions were responsible for £312,524 of the total which points to a general improvement in Empire electrical trade.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for April, 1929.	Inc. or dec. as compared with Mar., 1929.	Inc. or dec. as compared with April, 1928.	Electrical imports for April, 1929.	Inc. or dec. as compared with Mar., 1929.	Inc. or dec. as compared with April, 1928.	Electrical re-exports for April, 1929.	Inc. or dec. as compared with Mar., 1929.	Inc. or dec. as compared with April, 1928.
Electrical goods and apparatus (unenumerated)	£278,159	+ £31,211	+ £70,043	£132,284	+ £7,727	+ £31,277	£6,597	− £814	+ £320
Insulated wires and cables ...	285,241	+ 56,799	+ 55,196	65,814	+ 6,367	+ 14,950	109	− 225	+ 192
Glow lamps	52,638	+ 12,990	+ 11,427	23,376	− 25,725	− 376	697	− 291	− 498
Arc lamps and parts ...	2,040	+ 1,409	+ 469	366	− 465	− 3,743	41	+ 39	+ 25
Batteries and accumulators ...	76,151	− 1,039	− 5,629	42,625	− 2,163	+ 5,036	198	+ 96	− 364
Meters and instruments ...	30,033	+ 3,984	− 3,424	14,525	− 8,402	− 5,848	1,298	+ 526	—
Carbons	698	+ 540	− 21	21,769	+ 3,184	+ 7,902	218	+ 202	+ 156
Switchboards (not telegraph or telephone)	5,057	− 574	+ 1,357	131	− 26	+ 99	6	+ 6	− 13
Electrical Machinery—									
Electrical machinery (unenumerated)	329,092	+ 35,495	+ 57,315	145,977	− 3,826	− 2,348	11,845	+ 5,640	− 2,531
Railway and tramway motors	15,578	− 36,833	− 443	—	—	—	—	—	—
Other motors and generators ..	165,674	+ 25,427	− 47,787	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	145,568	+ 105,043	+ 68,776	6,071	+ 2,540	− 3,420	—	—	− 89
Submarine telegraph and telephone cable	21,264	+ 18,650	+ 8,964	—	—	—	—	− 4	—
Telegraph and telephone instruments and apparatus ...	267,041	+ 48,441	+ 28,500	90,299	− 7,998	+ 45,666	4,662	+ 2,122	+ 2,039
Totals	£1,674,234	+ £301,543	+ £244,743	£543,237	− £28,787	+ £89,225	£26,071	+ £7,297	− £763
	Exports			Imports			Re-Exports		
Inc. or dec. for four months ...	− £79,717			+ £199,385			− £10,202		

London's Electricity Supply.

The Joint Authority's Report for 1927-28.

IT is only about six months ago that the London and Home Counties Joint Electricity Authority issued its first report in continuation of the series compiled by the London County Council. We have now received the second report covering the year ended December 21st, 1927, in the case of company undertakings, and that ended March 31st, 1928, in the case of municipalities.* For the first time the report is prefaced with a useful summary of the statistics; this saves a great deal of time and trouble and is to be commended. A coloured map of the area showing its division among the various supply authorities is also supplied.

The Electricity District has an area of 1,797 sq. miles, with a population (1921 Census) of 8,178,166 and an assessable value (April, 1927) of £83,340,000. At the end of the period covered there were 93 supply authorities with 1,254,507 kW of generating plant (against 1,103,647 kW in 1926-27). These authorities are classified as follows, the proportion of generating plant which they own being shown in parentheses:—Metropolitan borough councils, 16 (27.2 per cent.); extra-London local authorities, 28 (15.5 per cent.); London companies, 16 (51.2 per cent.); and extra-London companies, 33 (6.1 per cent.). Of these undertakings only three had a load factor of over 40 per cent.; there were 11 showing between 30 and 40 per cent.; 60 between 20 and 30 per cent., and 16 under 20 per cent. The figures for three undertakings were not available. The total connections rose from 1,907,489 kWh in 1926-27 to 2,170,778 kW in 1927-28; the division of these totals—municipalities 45.5 per cent., companies 54.5 per cent.—was the same in each year.

The total number of kWh sold (excluding bulk supplies to authorised undertakers) during 1927-28 was 1,493,880,881 kWh, as compared with 1,234,462,574 kWh in 1926-27, representing an increase of 21.0 per cent. The following is an analysis of the 1927-28 total:—Metropolitan borough councils, 23.1 per cent.; extra-London local authorities, 15.4 per cent.; London companies, 45.8 per cent.; and extra-London companies, 15.7 per cent. Of the total sales of energy (excluding bulk supplies aggregating 260,426,000 kWh) 39.6 per cent. was for lighting and domestic purposes (an increase of 18.5 per cent. over the previous year); 2.7 per cent. for public lighting (15.1 per cent. increase); 12.7 per cent. for traction (30.1 per cent. increase); and 45.0 per cent. for power (21.3 per cent. increase).

At the close of the period £70,592,497 (against £61,722,210) had been charged to capital account by the undertakings as a whole. This was divided up as follows: Generation, £25,924,300 (36.7 per cent.); main transmission lines, £6,137,305 (8.7 per cent.); distribution, £33,141,792 (47.0 per cent.); apparatus on hire and miscellaneous, £5,389,100 (7.6 per cent.). The working costs of all undertakings (including the cost of energy purchased, but not capital charges) totalled £8,556,020, or 0.82d. per kWh sold. The cost per kWh sold for the various groups were as follows: Metropolitan borough councils, 0.79d.; extra-London local authorities, 0.96d.; London companies, 0.76d.; and extra-London companies, 1.00d. There were reductions in charges for all classes of supply: for lighting and domestic purposes the average price received per kWh fell from 3.75d. to 3.52d.; for public lighting from 1.62d. to 1.47d.; for traction from 0.90d. to 0.74d.; for power from 1.44d. to 1.25d.; and for bulk supplies from 0.96d. to 0.78d. These reductions represented a total saving of £1,240,100 to consumers. The revenue received for each class of supply by each group of undertakings is fully set out in a table. For lighting and domestic purposes the receipts per kWh were as follows: Metropolitan borough councils 2.62d.; extra-London local authorities 2.84d.; London companies 4.30d.; extra-London companies 4.56d. For power the receipts per kWh were 1.18d., 1.19d., 1.41d., and 1.12d., respectively.

The gross surplus on working for all authorities was £7,601,421—municipalities £2,587,856, companies £5,013,605. In the case of the municipalities the following appropriations were made: Interest on loans and deposits, £717,230; sinking funds and loan repayment, £927,123; applied to capital outlay, £311,914; reserve, depreciation and renewal funds, £358,137; contributions to rates, £92,081. The balances on the municipalities' net revenue accounts were increased by an aggregate of £181,201. The figures for the companies are incomplete, but it is shown that interest on loans and deposits absorbed £995,635; reserve, depreciation and renewal funds £1,473,247; preference dividends £535,218; and ordinary dividends, £1,330,395. The aggregate balance remaining was £641,495.

The report gives exhaustive particulars—technical and financial—relating to each authority in the area, and at the end there appears the statement of charges made by the individual undertakers as at January 1st, 1929, which was recently issued as a separate publication.

* Published by the Authority, 5, Millbank, S.W.1. Price 5s.

Patent System Reform

The British Science Guild's Proposals.

A PAPER dealing with "The Reform of the British Patent System" was read last week before the Royal Society of Arts by Mr. R. Burrell, barrister-at-law. In this the author traversed the recent report of the Committee appointed to consider the subject by the British Science Guild, and stated the case for and against the proposals. After pointing out that foreign patent systems had to be borne in mind on account of the International Convention, he said that the development of the British system was always closely watched abroad, and changes in it would possibly be followed by alterations in foreign patent laws which might not be to our advantage. The British Science Guild recommendations aimed at ensuring (*a*) a greater degree of security against the grant of invalid patents; (*b*) the extension of protection to certain inventions which were at present unpatentable; (*c*) a reduction in the cost of patent litigation; and (*d*) the easing of the congestion at the Patent Office and a speeding-up of procedure. Under the present system, the author said, the examination was limited in that it did not extend to all prior documents which might come before the Court if the patent's validity was challenged. It was therefore proposed that such documents should come within the scope of the Patent Office, and also that a patent should not be invalidated by the publication of any document more than 50 years before the date of the patent; the latter was already embodied in the Australian law. The French system of leaving the question of novelty to the Courts would not be likely to appeal to British manufacturers. Another matter for consideration was whether the retention of the principle of granting patents to importers of inventions was desirable. The Guild proposed that prior publication, through inadvertence or ignorance, should not militate against the grant of a patent if it occurred within twelve months prior to the application, but that would run contra to foreign practice, and might make inventors careless. There was, however, a case for protection in the case of prior secret use by the inventor. Extension of the grant of patents of addition, recommended by the Guild, was considered to be open to a number of objections. The grant of a patent in respect of an invention was dependent on its usefulness, and the Comptroller was compelled to accept or reject an application with this in view. It was suggested that the Comptroller might be provided with an intermediate course in the form of an endorsement on the specification if he was not satisfied that the invention had been described in a practical form. The author was rather doubtful whether this could be fairly carried out. The Guild recommended that inventions which were at present unpatentable should be protected and referred to biological patents; the author added some others, such as processes involving electrical action at a distance. That led to the subject of short-term patents, similar to the German "Gebrauchsmuster" system. The proposal was that such articles as utensils, tools, machine parts of a novel and convenient shape, &c., should be protected for a term of not more than seven years by short-term patents which would be cheaply and promptly granted and would not be liable in the same degree as full patents to invalidation on the ground of lack of subject matter. While the author agreed that some such form of protection was desirable, he was not sure that the method proposed was the most desirable. It might lead to abuses which could not easily be guarded against. A very careful inquiry into the operation of the "Gebrauchsmuster" system should be made before any similar system was introduced into this country. With regard to the proposals for reducing the cost of patent litigation, Mr. Burrell agreed that patent actions might be tried before the Comptroller, with an appeal to a special judge in chambers. At present patentees hesitated to incur the costs of a High Court action. There was also room for extension of the remedy against unwarranted threats of legal proceedings to cases taken under provisional or unsealed complete specifications. As to delay in dealing with specifications, the author doubted whether the institution of short-term patents would lead to relief of the congestion in the Patent Office; in fact it might add to that congestion. The only remedy was an increase in the strength of the examining staff. In the last 16 years, in spite of an increase of 26.2 per cent. in the number of complete specifications filed, there had been a decrease of 9.9 per cent. in the staff, and consequently arrears were increasing. The author considered that if the necessity for working were abolished by international arrangement it might be possible for British manufacturers to set up factories in this country for the purpose of working other inventions which it would be uneconomic to establish if working in other countries were necessary. A proposal that the period between the filing of the provisional and complete specifications should be extended to twelve months, to correspond with the priority period under the International Convention, would be of considerable value to British patentees. The author thought that at the same time a time limit should be placed on the Patent Office in dealing with specifications.

After reviewing other suggestions for reform, Mr. Burrell concluded with a proposal that the British Science Guild should convene a conference of the interests concerned.

The Central Electricity Board.

Extracts from the First Annual Report Covering a period of Twenty Months.

(*Concluded from p. 872.*)

The Electricity Commissioners had to investigate many of the questions which arose in connection with the design and layout of the "grid" in order that estimates might be prepared for consideration with the schemes. This work has lightened the Board's task to a very considerable extent, particularly on the technical side. With a view to taking full advantage of the information which had been accumulated in preparing the schemes and avoiding the creation of a large technical staff to deal afresh with that matter, the Board decided at an early stage to engage the consulting engineers who had been advising the Commissioners, and appointed Messrs. Kennedy & Donkin for the Central Scotland scheme, and Messrs. Merz & McLellan for the South-East England scheme; subsequently they appointed Messrs. Highfield and Roger Smith for the Central England scheme and Messrs. Kennedy & Donkin for the North-West England and North Wales scheme.‡

The Electricity Commissioners' decision in favour of 132,000 volts was influenced to a certain extent by the possibility that at some time in the future short lengths of underground cable might be found to give reliable service at this working pressure where circumstances might warrant the heavy additional capital expenditure involved. Shortly after the Commissioners transmitted the first scheme to the Board the International Electro-Technical Commission, in fixing standards for e.h.p. transmission lines, abandoned 132,000 volts as a standard, and now has no intermediate steps between 110,000 and 165,000 volts. Investigation of the cost of the various kinds of plant required showed that if the voltage was raised from 132,000 to 165,000 volts, the capital expenditure on the "grid" would be increased by 12 per cent. without making it possible profitably to utilise the increased carrying capacity which would thereby be obtained. If the voltage were reduced to 110,000 volts the capital cost of the system would be increased by approximately 5 per cent., as in many instances lines would have to be duplicated in order to provide the necessary capacity. Although the voltage of 132,000 is now no longer a standard of the International Electro-Technical Commission, it is in extensive use in Australia, Brazil, France, India, Italy, South Africa, Spain, Sweden, Switzerland, and the U.S.A. Utilisation of this voltage is, therefore, unlikely to affect prejudicially the cost of apparatus.

For secondary transmission lower voltages than that adopted for the main "grid" will be utilised. Some 93 circuit miles of 66,000-volt single-core cable will be laid in the inner London area, but by far the greatest proportion of the other secondary lines of the Board will be overhead lines carried on lattice steel towers and operating at 33,000 volts. Reinforced-concrete and wood poles are also being used on some sections of the secondary system. Steel-cored aluminium conductors will be employed throughout for the main "grid," and similarly on the secondary lines, unless in the latter instance the price of copper justifies a departure from the Board's standard practice.

The measurement of energy transfer and maximum demand in accordance with the requirements of the Electricity (Supply) Act, 1926, necessitates the installation of new and elaborate instrument equipments at all "grid" stations. Investigations made by a special engineering sub-committee culminated in the formation of standard methods of meeting these requirements. Energy measurements will be made by induction kilowatt-hour meters of the highest accuracy obtainable. Measurements of maximum demand involve algebraic summation of the demands on generators and on the associated grid transformers; special instruments are being developed for the purpose by the principal British meter manufacturers. The regulations foreshadowed in the 1926 Act governing the variations of grid tariff with power factor have not yet been issued by the Electricity Commissioners, but provision has been made for accurate power-factor measurements at times of maximum demand; the method adopted is to utilise summation reactive component meters corresponding with the kilowatt-hour meters installed for energy measurements. The complications introduced by the use of so many instruments is such that only partial duplication of equipment is being adopted. Thus only one complete summation system will be used in each station, and in the event of failure of such meters, recourse must be made to clerical methods for obtaining the data required by the accountants. Summation of maximum demands of different power stations will be done from graphical records of the load curves on the individual stations.

To enable control engineers to supervise the operations in their areas an elaborate system of signalling and communication has been devised, and will be carried out through pilot wires which will be hired from the Post Office. The actual operation of switches at the grid sub-stations will be carried out by the engineers at the individual stations in the first instance, but it is hoped that it will be possible to do this work from the central control rooms, when the complete reliability of the pilot system and apparatus has been established.

The development of communication and supervisory control systems by means of high-frequency current directed by the power lines is being kept in view. At present the line sections in Great Britain are too short to justify the use of "wired wireless" systems, but it seems probable that they may ultimately displace the pilot systems, which consideration is further justification of the policy of hiring pilot wires rather than of laying new ones.

The Board is making arrangements for providing an operating staff for each of the districts; it is recognised that British conditions are such that excessive reliance on previous experience in other countries is not justifiable, but the practice of companies operating large transmission systems in America and on the Continent is being taken into consideration.

The Board invited tenders for the main transmission lines in Central Scotland (the first scheme) in September, 1927; for the transformers in November, 1927, and for the switchgear in January, 1928. In the second and subsequent schemes it was able to proceed more quickly, and by the end of last December contracts had been placed as shown in Table II.

TABLE II.—CONTRACTS PLACED.

Item.	Central Scotland.	South-east England.	Central England.	North-west England.	Total.
	£	£	£	£	£
Primary transmission lines.	439,239	980,084	30,743	—	1,450,066
Secondary transmission lines.	—	14,235	—	37,139	51,374
Primary transforming stations.	649,685	633,038	—	—	1,282,723
Secondary transforming stations.	64,182	32,922	—	13,723	110,827
Totals ...	1,153,106	1,660,279	30,743	50,862	2,894,990

In Scotland the actual erection of towers is in progress on the routes Greenock-Yoker, Port Dundas-Dalmarnock, and Clyde's Mill-Bonnybridge, which are nearing completion. In south-east England work is in progress on the line from Bedford to Little Barford, 46 towers out of approximately 73 having been completed. In north-west England towers are being erected on the secondary line from Stockport to Macclesfield.

The routes of the lines are largely determined by the configuration of the land, and deviations can only be made within small limits and generally at considerable cost. The Board welcomed representations and co-operation from societies and local authorities concerned in the preservation of the amenities of the countryside, and it acknowledges the helpful and public spirit in which the majority of landowners have recognised the need of facilitating the Board's work, even when it has not been possible to make those minor alterations which the owners desired. Up to December 31st last the position was as shown in Table III.

TABLE III.—WAYLEAVES.

	Mileage Surveyed.	No. of Towers to be Erected.	No. of Wayleaves Obtained.
Primary Lines.			
Central Scotland	245	1,442	1,158
S.E. England ...	120¾	730	416
Central England	9¼	61	12
Secondary Lines.			
N.W. England ...	12	100	100
S.E. England ...	6¾	86	23

Individual undertakers may require additional supplies before the "grid" reaches them in the normal course. To meet such cases the Board exercises, wherever possible, its powers to make temporary arrangements and, where necessary, to construct portions of the "grid" in advance of its programme. By this means it already claims to have demonstrated the utility of the "grid" in saving authorised undertakers uneconomical expenditure on the extension of small generating stations and in making supplies available in new areas. Arrangements, including the construction of lines, have been made to give supplies at (*a*) Little Barford, for the development of new area in Bedfordshire, Cambridgeshire, and Hunting-

‡ Messrs. Merz & McLellan have since been appointed for the Mid-East England scheme, 1929.

don; (*b*) Worthing, to supplement existing supplies; (*c*) Aylesbury, to supplement existing supplies and open up rural areas; and (*d*) Macclesfield, Buxton, and the surrounding district. Other arrangements of a similar nature are in negotiation for supplies in and around London, at Kettering, and in the Alderley Edge and Wilmslow district.

In order to provide for expenses during the initial period before the disbursements of the Board become sufficient to justify raising a loan, the Board arranged with the Bank of England for temporary advances and that arrangement still continues. The total amount of such advances up to December 31st last was £339,000.

There are seven appendices to the report, the first of which sets out the advantages and economies to be derived from interconnection; the next four give technical details of the "grid"; appendix 6 is a progress report, and the final one reproduces the Board's standard form of Wayleave consent. In conclusion, attention may be drawn to fig. 2, reproduced last week, which shows standard 66-ft. straight-line towers used for transposition spans in Central Scotland. It is part of the first 20 miles of "grid" line to be switched in at full pressure the week before last, and was erected by British Insulated Cables, Ltd., of Prescot, who also made alive part of another similar line at Bedford, which, however, is temporarily at 33-kV, but is to be increased later to 132 kV. The other illustrations were reproduced from the Board's report and the switchgear works referred to are presumably those of the B.T.H.

The Battersea Power Station.

A statement in defence of the position of the London Power Co., Ltd., relative to recent criticism in the daily Press of its intention to build a large electricity generating station in London.

THE following communication, signed by Mr. W. F. Fladgate, chairman of the company, has been issued by Dr. S. L. Pearce, its engineer-in-chief:—

"The London Power Co., Ltd., has not hitherto intervened in the controversy recently arisen in the Press and elsewhere regarding the erection by the company of a power station at Battersea, but the time has now, I think, arrived when I should state for the information of the public the material facts of the case and explain the views and intentions of the power company.

"The express object of the establishment of the London Power Company, which was incorporated in 1920, was to eliminate inefficient and uneconomical stations, to improve those which were reasonably efficient and economical, to link up the latter, to provide new stations when and where required, and generally to promote economy, efficiency, and reliability in the production of electrical energy for the metropolis. The London Electricity (No. 2) Act, which was promoted by the company, received the Royal Assent on July 31st, 1925. At the same time the London and Home Counties Joint Electricity Authority was constituted under an Order dated July 29th, 1925. The Central Electricity Board was constituted under the Electricity (Supply) Act, 1926, and was actually set up early in 1927.

"It is the statutory duty of the power company to make provision for the supply of energy to that portion of the metropolis which is within the areas of its ten constituent companies, and it was very early realised that a new station towards the centre and west of their districts would be absolutely necessary in the near future. The question accordingly arose of an appropriate site for the new station, and after exhaustive inquiry negotiations were entered into in 1925 for acquiring a site from the Duke of Northumberland at Brentford. A Bill was promoted in Parliament in the autumn of 1925 for the purpose of obtaining the requisite sanction, but was rejected on second reading by Parliament, the proposals for the Government Act of 1926 then being under consideration. Subsequently the Joint Electricity Authority entered into negotiations for erecting a station at Chiswick, and it promoted a Bill for that purpose. That Bill came before Committees of both Houses and was heavily opposed, every possible objection being advanced and, in particular, the nuisance which it was apprehended might be caused by the erection and working of the station. Notwithstanding the objections, both Committees passed the Bill, subject to a recommendation that it should not be proceeded with unless it was 'selected' by the Central Electricity Board.

"In his evidence before the Parliamentary Committees in 1927, on the Chiswick power station Bill, the chairman of the Electricity Commissioners made the following statement:—

> That makes it all the more certain that two stations, indeed even these two stations (referring to Chiswick and Battersea) will be inadequate to deal with the western load in the years to come. Of that there can be no doubt whatever. When I tell you that the rate of growth is such as I have said to require both these stations, and that, curiously enough, when one analyses the growth which is taking place, one finds that 60 per cent. of the total load in the whole area is in the central and western districts, it points distinctly to the erection of stations in the western part of London rather than in the eastern.

"The question of erecting a station on the Battersea site had meantime come before the directors of the London Power Co. in the later part of 1926, and they were advised that from the engineering and economic points of view the site was the very best that could possibly be obtained. They made no secret of the fact that they were acquiring that site, and brought their project prominently before the Committees of both Houses when the Chiswick station Bill was under consideration, not by way of opposing the proposal of the Joint Electricity Authority, but as a complementary proposition. Before definitely deciding on the Battersea site, the London Power Co. gave very careful consideration to the question of an alternative site down the river. In view of the heavy transmission costs it was quite unable to make out an economic case for such a site, and a more recent survey and consideration of this possibility, with estimates based on the use of still higher voltages, has confirmed the correctness of the earlier opinion.

"One of the first steps taken by the Central Electricity Board after its constitution in 1927 was to consider the scheme for the South-East of England prepared and transmitted to the Board by the Electricity Commissioners. The scheme scheduled several stations of the London Power Co. as "selected" stations, and the station which was proposed by the Joint Electricity Authority at Chiswick was put forward in that category. The Central Electricity Board gave the most careful consideration to the scheme which had been prepared, and as the result on February 15th, 1928, it discarded the station at Chiswick and selected for adoption the station at Battersea. The whole of the approved plans for dealing with South-East England and the transmission system in connection therewith are based upon the erection of a station at Battersea. The Power Company, which had acquired the site at a very high price, accordingly proceeded with the completion of its plans for the Battersea station, which had been submitted to and approved by the Electricity Commissioners and had also been approved by the Central Electricity Board. Considerable progress has now been made in the construction of the works and plant.

"So far as the commercial side of the undertaking is concerned, it is right to point out that the London Power Co. is in no sense a commercial undertaking. By its constitution it is precluded from making any profit. It can only pay a fixed interest on its securities. The whole of the saving which the company may be able to make is to be applied in reducing the charges for electricity to its constituent companies, thus enabling those companies to supply the public of London at a cheaper price.

"When, in 1927, the Electricity Commissioners (after consultation with the Office of Works) issued its statutory consent under the Act of 1919 to the erection of the Battersea station, it attached to its consent the condition:—The company shall in the construction and use of the said generating station, take the best known precautions for the due consumption of smoke and for preventing as far as reasonably practicable the evolution of oxides of sulphur, and generally for preventing any nuisance arising from the generating station or from any operations thereat.

"The London Power Co. has always fully recognised the importance of the obligations thus imposed upon it, and from the outset has given careful consideration to the steps to be taken to secure its performance. In particular, as regards the treatment of the flue gases from the boilers, which is the topic to which criticism has recently been chiefly directed, the company has specially invoked the assistance of its own and independent expert chemists in connection with the design and equipment of the station. It is no doubt true that the problem of dealing with sulphur fumes is a comparatively new one in its application to power stations, but it is manifestly unfair to the London Power Co. to pronounce it in advance to be incapable of solution, and to do so casts an unmerited slur on the present state of advancement of the arts of engineering and chemical science. The advice which the company has received from its advisers, to whom it has given the freest possible hand, fortunately belies the pessimistic anticipations which have been so widely circulated, and affords reliable ground for believing

that by the proper selection and pre-treatment of the coal before burning, and by the adoption of suitable plant of the best design and layout, it is practically possible to render innocuous the fumes which arise in the process of generation. I can assure the public that the company will not be deterred by any considerations of cost from adopting every possible precaution which can be devised. It is in its own interest to do so. Problems of no less difficulty have been surmounted in the past history of the electrical industry, and in the words of *The Times* leader of April 2nd—'There is no reason to take an unduly gloomy view of the future.' Lest the omission by me of any reference to smoke and dust should be construed as evidence of the company's inability to cope with these, I may say at once that not the slightest apprehension is felt by the advisers of the company on this score. There is an abundance of experience to work upon in this connection.

"I turn now to another and different aspect of the matter. I refer to the criticism that the erection of a power station at Battersea would be 'an economic mistake.' Let us examine this question, which, after all, is only a variation of the oft-debated problem whether it is more economical to site a station (*a*) as near as possible to the centre of gravity of its load, or (*b*) at some distant site which may have the advantage of remoteness, but has the concomitant disadvantage of necessitating long overhead, or cable, trunk lines traversing (in great part) congested areas by several divergent routes.

"Careful estimates have been prepared of the transmission capital costs and annual losses which would be involved in dealing with the whole of the energy from a station of the size of Battersea located some 15 to 17 miles down river, as compared with a station on the Battersea site. The estimates are necessarily only approximate in the absence of a detailed survey of the possible routes. They do, however, cover transmission partly by overhead lines, where feasible, and partly by cables, and at the alternative voltages of 66,000 and 132,000 V. Space does not permit me to go into great detail, but, shortly, it may be said that in the case of a station at the suggested distance the extra capital costs on transmission would range from £3,000,000 to £1,850,000, according to the system and voltage adopted. After due consideration and making allowance for all contingent factors incidental to the use of a transmission voltage of 132,000 V, on the most favourable basis it would not appear safe to reckon on a lower figure than £2,100,000.

"Against the incidence of the capital charges on this latter figure, together with the line-maintenance costs, the line losses, and the rating, may be set the saving of sixpence per ton on sea-borne coal direct to both sites, by steamer, amounting in the aggregate and on the ultimate output of the station to some £15,000 per annum. Most careful inquiries have been made before accepting the above figure of sixpence per ton, and the company is assured that although this figure may fluctuate slightly from time to time it is an outside figure and should be accepted by 'anyone who knows the trade.' The advisers of the London Power Co. have come to the definite conclusion that (apart from the difference in value of the respective sites, which, after all, has no very appreciable bearing on this question) there would have to be a difference in the cost of coal of at least six shillings per ton in favour of the down-river site to justify its selection, and to counteract the additional transmission and transformation costs.

"It will, I think, be generally admitted amongst engineers that cables operating at 132,000 volts and upwards are at the present time more or less 'on trial.' They can hardly be said as yet to have emerged from the experimental stage, and experience is very limited. Whatever the future may hold in store in this direction, and it is probably hopeful, a note of caution is surely necessary before London is committed to such a system for the transmission of the entire energy output of a station of the magnitude of Battersea situated on the lower reaches of the river. It is understood that the Central Electricity Board has placed an order for a limited amount of this class of cable. This work is, however, regarded by that body as being of a trial or experimental character, and the order has been placed at the entire financial risk of the contractor, with stringent guarantees of replacement by cables operating at lower voltages.

"It may be convenient to refer at this point to a further observation made by Sir John Snell, when considering the Chiswick Bill before the Parliamentary Committees, which has a distinct bearing on the present case: namely, that owing to the high cost of laying cables through the congested streets of London, and the high cost of reinstatement of the paving, &c., it is not commercially practicable to transmit the large quantities of energy which are, and will be, (particularly *will* be) required in the west-end of London, wholly from the eastern end. In this view the London Power Co. most fully concurs, fortified as it is by its experience of the present condition of the streets in the area in which it has the right to lay cables, namely, the whole of the County of London. In these circumstances, if energy generated at stations on the lower reaches of the river Thames has to be transmitted to the west, it could only be done by devious routes north or south of the metropolis, thus adding very greatly to the transmission costs, which addition has not been fully taken into consideration in compiling the foregoing estimates.

"The London Power Co. does not subscribe to the principle that a generating station should be located near to a particular colliery, or to a particular group of collieries, which is not in its ownership, or under its control. It believes that the best interests are served by selecting a site available, if need be, to all the coal fields of the country. If the Kent coal be all that is claimed by its sponsors, there is nothing to prevent its use at the Battersea site.

"Reference has been made to the practice in other countries with the suggestion that the example should be copied in the case of London. What are the facts? Take Berlin for an illustration: at the present time the bulk of the electrical requirements are supplied from four power stations within the City limits, and a fifth station, also within the City, is under construction. By the year 1932 it is estimated that out of a total demand of 720,000 kilowatts, only some 60,000 kilowatts will be sent in to the City from stations situated on the brown-coal fields, in the form of bulk supply. There is little here, therefore, to support the argument advanced against Battersea in favour of long-distance transmission from remotely situated stations. The position in Paris is similar. The case of Melbourne and the Norwell brown-coal fields has no relevance to the present controversy, as will be admitted by those who have any knowledge of the situation, political and economic, in Victoria, Australia. Again, take the large American cities, *viz.*, New York, Brooklyn, Chicago, Baltimore, Philadelphia, Milwaukee, &c. Their stations are either entirely, or mostly, within the city limits and as close up to the load as possible. This is particularly the case in New York, where huge stations (greatly in excess of Battersea) are located in some of the densest parts of the city, one such new station now in commission being designed for an ultimate capacity of 1,000,000 kW, and be it remembered that American coals, especially those of the Middle West, are much higher in their sulphur content than are British coals, and yet the sulphur problem does not appear to have impressed itself on our American friends.

"It has been stated that a proposal brought forward in 1906 by the London County Council for the erection of a station at Battersea was rejected by Parliament. Agreed! The ground of the refusal was not the unsuitability of the site, but the desirability of bringing forward a more comprehensive scheme for London and the surrounding district.

"The whole object of the building of these new modern stations is to bring about two things: first, the gradual elimination of a number of other stations which are less efficient, which burn more coal per unit generated, which are liable to cause nuisance, and are not in a position to adopt the up-to-date improvements that large new stations can afford to include; and, secondly, the reduction by the increase in the use of electricity of the quantity of coal burnt, both industrially and domestically. On balance, there can be no doubt that a less quantity of deleterious fumes will find its way into the atmosphere under the modern system than under the existing regime. The South-East England Electricity Scheme forms part of a comprehensive scheme for the British Isles, which has been formulated for the express purpose of providing electric light and power in greater quantities and at less cost than hitherto. Any hindrance of the scheme can only be regarded as retrograde and would delay the closing down of less suitable stations.

"This statement has already run to much greater length than the importance of the subject merits. I conclude by summarising the position as it appears to the London Power Co.:—

(*a*) "The principle of establishing a power station on the river within the metropolitan area was before both Houses of Parliament so recently as 1927 and was approved by them after very exhaustive investigation and on evidence for and against, which dealt particularly with the question of the alleged nuisance caused by chimney fumes.

(*b*) "The London Power Co. obtained the statutory sanction towards the end of 1927 for the establishment of a power station at Battersea of the body expressly set up by Parliament in 1919 to decide all such matters.

(*c*) "The Battersea station was approved and selected by the Central Electricity Board in 1928 as an integral feature of its adopted scheme for South-East England after hearing objections thereto, principally on the ground of nuisance.

(*d*) "On the strength of its statutory position the London Power Co. has raised three millions of money for the express purpose of building a station on the site sanctioned.

(*e*) "The London Power Co. has entered into contractual obligations for civil engineering works and plant, including the purchase of the site, amounting to £2,000,000, in every case with British firms employing British labour.

(*f*) "It has not been proved, nor indeed even seriously suggested until quite recently, that it would have been economically sounder to have built the station on the lower reaches of the river.

(*g*) "Neither has it been demonstrated that the disastrous effects upon the atmosphere which have been so freely foretold in communications founded in many instances on an entire misconception of the position, are in the least likely to materialise in actual practice. In this connection, as an example, one has only to refer to a statement made to the effect that with the station completely erected and working at full capacity, then using from 10,000 to 12,000 tons of coal per week, one-third of the total plant will use 2,000 tons per day. Our critics might at least be arithmetically accurate."

Architectural Illumination.

Some modern tendencies in architectural form with electric light as an integral factor in exterior and interior decoration.

(A report of a meeting of the Architectural Association.)

NEGLECTING all aspects of a technical or commercial nature, the illustrated lecture bearing the comprehensive title of the above sub-heading recently delivered by Mr. G. S. Francis, of the British Electrical Development Association, dealt with the subject from the point of view of artistic orientation. It was, in essence, an amplification of the paper read before the E.D.A. Salesmanship Conference in London, by Mr. H. T. Young,* who gave such a useful exposition of the tendencies in illumination development by way of broad masses of light and a departure from lighting by means of single points. Indeed, among the slides shown by Mr. Francis were several of Mr. Young's own very attractive showroom, typifying this development, as well as others that were shown by Mr. Young. At the same time, Mr. Francis dealt with the whole subject in a profound way from the architectural point of view, and judging by the discussion that followed, clearly aroused the interest of architects in one very important direction, *viz.*, the absolute necessity for treating lighting as part of the original design of a building. Actually, the lantern slides were more eloquent of the trend of development than the description given by the lecturer, the slides representing some remarkable effects in theatre lighting on the Continent, notably in Berlin and Dresden, and the lighting of other places of amusement, as well as business premises both on the Continent and in this country. The point was emphasised by Mr. Francis that a renaissance was now visible in the sphere of artificial illumination; that a new spirit had entered the field and had already begun to direct the use of electric light into new and attractive channels. It was shown convincingly by means of the slides that in all the leading countries of the world a departure was being made from convention through the evolution of means to employ electric light in broad masses instead of isolated points, whilst lighting fittings designed in the modern manner exhibited in an interesting fashion the growing feeling for the artistic properties of the line, the angle, and the plane.

In this connection, it was also pointed out how modern feeling for architectural form was undergoing a metamorphosis This was shown by the changing style of buildings, both exterior and interior, and so far as interior illumination was concerned, the lighting fittings must be designed, and the disposition of the light arranged, to harmonise with the general design and spirit of the structure. Whilst, continued Mr. Francis, casual examples of cornice, window, and skylight illumination had been known for ten years or more, the real stimulus towards the bolder and more consistent development of decorative lighting probably dated from the Paris Exhibition of 1925. A significant feature of such development was its bold departure from the use of points of high intensity to the employment of larger masses of low-intensity light as a groundwork upon which higher light values could be used in accord with the designer's plan. With that appeared also a marked restraint in the use of ornament and closer attention to the texture and colour of the transmitting medium. Another feature was the evolution of housing units for the lamps which could be incorporated in the structure of the building in the form of ceiling or wall panels, luminous cornices, lintels, columns, &c. Other effects could be obtained by reflection, by diffusion through some translucent material, and by a combination of both, with added elements of direct lighting placed at strategic points to give emphasis to desired features.

Finally, Mr. Francis, in pointing out that lighting development of that nature was yet in its infancy, readily acknowledged that some of the designs being made use of on the Continent would probably fail to meet the taste of the age and would fall by the wayside, but others would develop on lines that possessed survival value and would live on through progressive metamorphosis until true artistic expression was found.

It may be added that not the least interesting of the slides shown were several differing views of the effective showroom that has been arranged by the E.L.M.A. Lighting Service Bureau, which has been designed specially to demonstrate this new form of electrical illumination in its various phases. Many striking examples were also shown of the flood-lighting of buildings, &c.

Discussion.

The discussion, naturally, was carried on mainly by architects and others than lighting engineers, and was the more interesting on that account as giving the lighting engineers engaged in development work a clear indication of the trend of taste in this matter.

Mr. Howell Robertson, who proposed a vote of thanks to Mr. Francis, spoke of the manner in which the development of electric lighting hitherto had been restricted owing to the manner in which methods of applying older forms of illuminant, such as oil and gas, had been followed. At the same time he doubted whether the new form of lighting in broad masses would offer much in domestic fields by reason of its cost, although the manner in which it could be incorporated as an integral part of the architecture was another matter. Even when applied to commercial purposes it seemed to him that the modern form of lighting presented difficulties at the present moment as regarded economy, although no doubt as development took place that aspect would be taken care of. In a recent exhibition of that form of lighting at Messrs. Warings 38 lamps were used to illuminate a wardrobe, which was positively princely! At the same time, the new method could be applied with advantage to architecture on a larger scale than that associated with the domestic problem. The speaker criticised some of the fantastic designs for lighting public buildings and business premises in Germany, which were in such sharp contrast with the more pleasant designs in New York and London. Perhaps that was due in a measure to the fact that the lighting designer had at last been given complete freedom to do what he felt he was justified in doing, without any fear of offending against any particular canons of style. For instance, in shop-window lighting to-day there was no "style." The lighting was arranged purely from the point of view of the function it was to perform, with the result that the kinds of effect produced were almost endless.

Miss C. Haslett, secretary of the Electrical Association for Women, seconded the vote of thanks. Whilst urging the need for the collaboration of the architect and the engineer, she emphasised the necessity for giving full consideration to the woman's point of view in domestic lighting. There was, first, the difficulty of obtaining servants, and it must also be borne in mind that woman's expression was far more artistic to-day than it had ever been before. A great deal had been heard about Germany and France, but she would like to think that Great Britain would soon lead the way, because there was plenty of scope for true British art and craft in this development.

Mr. Gordon Selfridge said that some of the new lighting schemes on the Continent, as shown by the lecturer, were perfectly terrible and he hoped they in this country would be able to arrive at something definitely more beautiful, because from the architectural standpoint some of the schemes were as bad as they could be. They needed something less eccentric than was too often the case at the moment in France and Germany, and even in some cases in London. At the same time, those on the Continent were to be admired for the manner in which they tried out things, even if they were not so beautiful as might be desired, because out of such trials it was possible to arrive at something which would meet with final approval. They in this country were not fearless enough in taking up new things and trying them out. Expense was allowed to stand too much in the way, and yet from the commercial and business points of view such expenditure was often profitable in the long run.

Mr. Stanley Hamp, as an architect, expressed satisfaction that at last they had reached a stage at which it was possible to embody lighting in a building in other forms than merely those of the pendant and the bracket. At the same time, there was difficulty in obtaining the necessary materials in this country for carrying out schemes to the new lighting designs that had been illustrated. Was that because British manufacturers were not enterprising enough, or was it because the fittings were so impracticable from the domestic point of view that the manufacturer would not carry a stock? Personally, he thought it was a little of both. So far as arranging public buildings in the manner shown by some of the slides was concerned, there was the point that in the daytime the appearance of the building was spoiled, which was a matter that would have to be taken into consideration. At the same time, to get the best and most economical results, this form of lighting could not be dissociated from the general design of the building.

Mr. Hubert Baines, an engineer, who had an architect brother, spoke with some feeling of the manner in which the lighting engineer was too often treated. He was called in after the architect had completed his design, and then told to light the building. In his view buildings must be designed more for use in the future than they had been in the past, and that necessitated early co-operation between the architect and the engineer. Engineers had suffered very badly at

* Electrical Review, November 23rd, p. 909, and November 30th, p. 930, 1928.

times at the hands of architects in this respect. In the building where he had his offices the corridors were the best lighted portion, which was a disaster. It could not be too strongly emphasised that artificial light was used for 600 hours during the working year, and therefore demanded the most serious attention on the part of the architect. He specially mentioned that the corridor lighting in the new Imperial Chemical Industries building† had to be in use all the year round, and very careful consideration was given to that fact. With previous speakers, Mr. Baines expressed dislike of some of the bizarre designs exhibited by the lecturer, which, he said, were artistically bad and uneconomic; no sane person would have anything of the kind in his house. He also complained of the cost of the new form of lighting, and called attention to one of the slides of a bedroom, which had no fewer than ten lighting points in it. There was not ten lighting points in his bedroom for the simple reason that he could not afford them; cost was the all-important item when applying such systems to domestic purposes.

Mr. G. S. FRANCIS briefly acknowledged the vote of thanks. As regarded the criticism of the technique and economy of the methods he had illustrated, he reminded his audience that not only had he definitely not dealt with that aspect, but that he had also indicated that he thought some of them would fall by the way. His view was that out of what remained they would evolve something of a more permanent and pleasing character.

† ELEC. REV., March 22nd, 1929.

Domestic Electrical Developments.

New Cooking, Heating, and Cleaning Devices for use in the Home.

Vacuum Cleaner Improvements.

A small device which, it is claimed, will add greatly to the attractiveness of the "Cadillac" vacuum cleaner, marketed by METRO-VICK SUPPLIES, Trafford Park, Manchester, is a deodorising attachment called the "Sanit-Aire." This consists of a small perforated aluminium container which fits into the machine in the place of the front cap, and contains a special sanitising compound. It is attached to the suction side of the cleaner, and, without any appreciable loss of vacuum, forms an effective sanitary unit for dispelling moths and bacteria, and for generally purifying the air of the home. The smell of the special "Cedabloc" compound is most refreshing, and the volume of air moving over it quickly forms sufficient vapour to give a healthy and pleasant odour. A new model of the "Cadillac" cleaner embodies two minor improvements, a new design of stirrup, making for easier handling, and a removable handle for simplifying transport and packing. Fig. 1 shows the cleaner complete with the "Sanit-Aire," and fig. 2 depicts the deodorising unit separately.

Fig. 1.—Complete "Cadillac" Cleaner.

Fig. 2.—The "Sanit-Aire" Deodoriser.

New and Improved Fires.

A recent production of Electrical Utilities, Ltd., Tudor Works, Park Royal, N.W.10, is the "Riviera" fire, fig. 3. This is a very simply-constructed and compact little fire, measuring 14 in. high, 11 in. wide, and 3½ in. deep; it weighs 11 lb. The resistance wire is supported in the company's "Infra-Ray" refractory reflector. It is claimed that the combination results in an unusually large emission of radiant heat. The fire can be supplied with elements for 1-kW or 1¼-kW loadings, and in vitreous- and stove-enamel finishes. There is a choice of three colours, grey, green and brown, in vitreous enamel. The frame is of high-grade cast-iron. The fire is claimed to be a particularly suitable article for hire-purchase or hiring out schemes, because the finish is not easily damaged, all parts are readily interchangeable, and the resistance wire can be renewed without using a screwdriver.

Fig. 3.—The "Riviera" Fire.

Another development of Electrical Utilities is the "Heetrod" (wire) element, which is designed to replace the "Globar" or solid-composition "Heetrod" elements in various fires and cookers designed by the company for the

Fig. 4.—"Heetrod" Portable Fire with Wire Elements.

latter type of elements. The "Heetrod" (wire) element, fig. 5, consists of high-grade nickel-chromium alloy wound on a white refractory. An important feature of the element is the way in which the ends of the wire are brought under the control of the contact screw. This has a hole through it from head to point, and the end of the resistance wire is pushed through this hole. Another piece of metal is then wedged in all the way along, thus making, it is claimed, a solid joint which is not subject to variation in resistance under

Fig. 5.—"Heetrod" (Wire) Element.

any conditions. The result is that the ends of the element remain comparatively cool, and the spring contacts are preserved. Fig. 4 shows a "Heetrod" portable fire fitted with the new type of elements.

An Electric Water Boiler.

The "Two-Twelve" electric boiler, fig. 6, a product of Messrs. GEORGE MARCHMAN, Trinity Street Works, Bury, Lancashire, is designed to store and deliver boiling water for domestic and similar supplies. The equipment is governed so that immediately the whole of the contents of the boiler reach 212 deg. F., the emission of steam from the boiler switches off the main current, leaving a small bye-pass current to maintain boiling point. To ensure boiling water at the tap the final passage of the water is through a tube in which is placed one of the electrical elements. This enables the contents to be drawn off at boiling point until the surrounding water at the top of the boiler falls below 170 deg. F., so enabling large quantities of water to be stored and delivered at 212 deg. F. The boiler is claimed to be safe for use, as it is impossible to generate pressure in the apparatus. It is also claimed that, used in hospitals, the boilers supply boiling

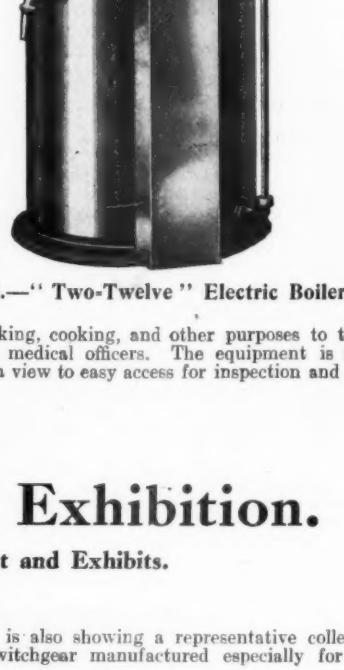

Fig. 6.—"Two-Twelve" Electric Boiler.

water for drinking, cooking, and other purposes to the satisfaction of the medical officers. The equipment is specially designed with a view to easy access for inspection and cleaning purposes.

The North-East Coast Exhibition.

Electrical Features of the General Lay-out and Exhibits.

(*Concluded from p. 892.*)

SEVENTY-five thousand persons attended the opening ceremony of the North-East Coast Exhibition by H.R.H. the Prince of Wales on May 14th. The Prince had a rousing reception. The aim of the Exhibition, he said, was to revitalise existing industries—to discover how they should be adapted, and, if necessary, improved. The march of time might have shown some branches of industry outliving their usefulness, and it was hoped that the great enterprise might serve to discover the weak spots, and, by encouraging the establishment of new works and new methods, provide further channels of labour in a district that had had more than its share of hard times. The North-East Coast had kept abreast of the times, and it must be encouraging to Tynesiders to remember that the turbine, invented by the distinguished President of the Exhibition, still enabled this country to hold the Blue Riband of the Atlantic.

The stand of Messrs. A. REYROLLE & CO., LTD., is arranged as a lounge in its central part, and interesting exhibits are suitably disposed round its outer border. A model of the world at one end of the stand symbolises the company's widespread activity, and draws attention to the places where "Reyrolle" designs are now being manufactured under licence. There are on this stand selected examples of the company's products, such as mining and industrial switchgear. These include two small oil-immersed flame-proof circuit-breakers, each with a current-carrying capacity of up to 100 A at 660 V. One of these is adapted for either pillar or wall mounting, and the other is mounted on skids, so as to be easily portable. The design is such, it is claimed, that all the regulations made under the Coal Mines Act (1911) are complied with. The oil tank is of welded boiler plate, and the circuit-breaker is well fitted to work under the severest conditions. Two or three series overload trip coils may be fitted to the equipment, and either inverse time-limit dash-pots, or tubes for instantaneous tripping may be included, each adjustable to give a wide tripping range. In the special case of controlling the supply of an a.c. squirrel-cage induction motor of a size suitable for switching direct on, a starting dash-pot may be fitted, so arranged that the operation of closing the circuit-breaker lowers the trip-coil plungers and thus prevents tripping from taking place under the influence of the heavy starting current. The plungers return gradually to their normal position while the motor is running up to speed, and are ready for normal operation under running conditions. A very useful feature of this gear is that one circuit-breaker can be completely removed from the framework, and the dividing box which carries the main cable can be transferred to another circuit-breaker without unsealing the cable. Another "Reyrolle" exhibit is a ring-main circuit breaker, fig. 4, designed especially for underground sub-stations. By virtue of specially designed "bell" joints it will withstand, it is claimed, total immersion in times of flood. This company is also showing a representative collection of the smaller switchgear manufactured especially for use in industry.

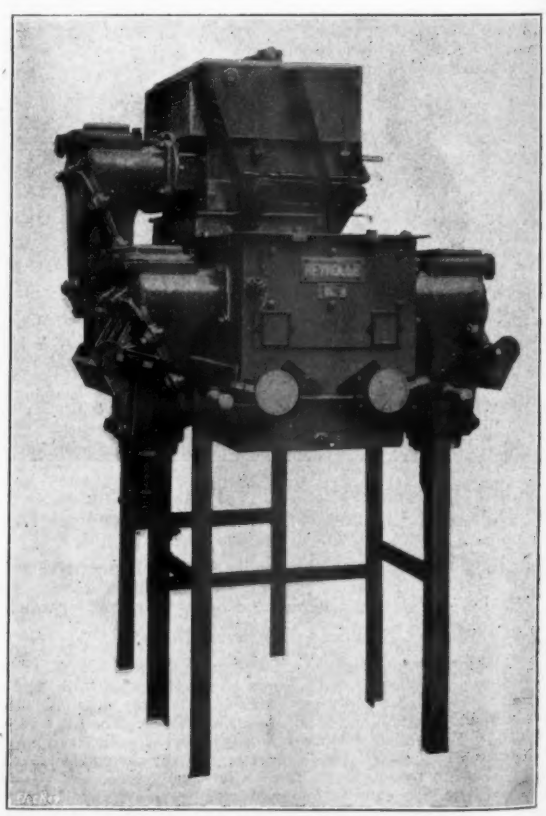

Fig. 4.—"Reyrolle" Ring-main Circuit Breaker for Underground Sub-stations.

The Sunderland Forge & Engineering Co., Ltd., is exhibiting a worm-geared electrically driven ship's cargo winch which is capable of lifting 3 tons at 120 ft. per min., 25 cwt. at 250 ft. per min., or, light hook 480 ft. per min. It is driven by a watertight motor, 33 h.p., 275 r.p.m. The winch has a centre barrel, two warping ends, and hand- and foot-operated brakes. There is also a contactor-type control gear suitable for mounting in a deck-house and for controlling the above winch. A similar winch exhibited is equipped with foot and magnetic brakes. A contactor-type control gear suitable for controlling this winch is also shown. Other exhibits on this stand include a worm-geared electrically-driven shipyard winch to lift 3 tons at 45 ft. per min.; a friction hoist fitted with a continuously-running motor and patent reversing gear, capable of lifting 10 cwt. at 200 ft. per min.; three open-type steam driven generating sets for ship lighting, 3¾ kW, 10 kW, and 21 kW, respectively; and two open-type generators for ship lighting and power, specially designed for driving by Diesel engines, 100 kW, 220 volts, 300 r.p.m.

The Cambridge Instrument Co., Ltd., is exhibiting a representative collection of instruments for ships and engineering

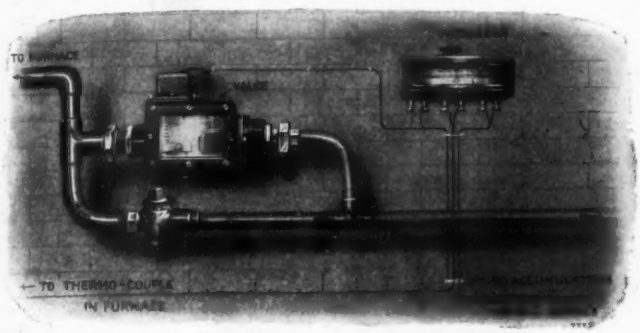

Fig. 5.—" Cambridge " Automatic Temperature-regulation Apparatus.

works, including electrical CO_2 indicators and recorders, apparatus for recording the percentage of dissolved oxygen in boiler-feed water, draught and pressure gauges, temperature-measuring instruments, and other instruments for engineering and electrical measurements. Some very interesting " Cambridge " instruments are also to be seen in actual operation on other stands in the Palace of Engineering. For instance, on the stand of the Newcastle and Gateshead Gas Co., there is an automatic temperature regulator controlling the temperature of a gas-fired furnace. It consists of a thermo-electric indicator, connected by suitable leads to a thermo-couple which is so placed in the furnace that it gives a true indication of the furnace conditions. Near the end of the indicator pointer is attached a light thermo-couple which is electrically connected to a moving-coil relay. A small electrically-heated coil is set to the point on the scale at which it is desired to maintain the temperature of the furnace. When this temperature is reached the small thermo-couple on the pointer is brought beside the coil and becomes suddenly heated, the electromotive force thus set up energising the relay and so completing an electrical circuit which operates the mechanism controlling the supply of heat. As soon as the temperature falls, the thermo-couple leaves the coil and the process is reversed. Fig. 5 shows the arrangement of automatic temperature regulation similar to that installed in connection with the Newcastle and Gateshead Gas Co.'s exhibit. The apparatus is capable, it is claimed, of controlling the temperature to within 1 per cent. of the range of the indicator scale.

A few firms are showing some interesting items of electrical domestic equipment, and included in a range of cookers being displayed by the Jackson Electric Stove Co., Ltd., is the No. 24D. cooker, fig. 6. This cooker consists of two standard No. 24 ovens, each with cooking space 19 in. high by 16 in. deep by 16 in. wide, and loaded at 2.7 kW. They are surmounted by a cast hob, containing two 8-in. by 6-in. hotplates, 1.5 kW each, two 12-in. by 7-in. hotplates, 2.25 kW each, one 14-in. by 8-in. hotplate, 3.0 kW, and one 13-in. by 10-in. grill, 2.5 kW. The top of the grill can be used as a simmering or boiling plate. Three-heat regulation is provided on all the above sections. Over the hob, mounted on two cast-iron brackets, are two No. 260-type hotcupboards. The space between the bottom of the hotcupboards and the top of the hob is filled in with a tiled-pattern splash plate. Each hotcupboard is loaded at 350 watts and controlled by a single-pole rotary indicating switch. The total loading of the cooker is 19.1 kW, and the approx. overall dimensions are 57 in. by 25 in. by 69 in. high. The Jackson Co. is also showing a comprehensive range of water heaters.

The Revo Electric Co., Ltd., has an interesting display of watertight electric light fittings, street light fittings, pendants, brackets, hand lamps, bulkhead fittings, cargo lights, brass brackets, brass pendants, winches, hoists, pulleys, electric fires, irons, kettles, hot plates, boiling rings, electric fans, and so on.

Model 700 vacuum cleaner is the chief exhibit of Hoover, Ltd. As does the No. 543 model, this cleaner embodies the deep-beating principle, and with both can be used the " Hoover " floor polisher, a device which is inserted in the machine in place of the agitator.

Electrolux, Ltd., have their usual excellent display of the " Electrolux " cleaner, refrigerator, floor polisher, and so on.

An interesting range of domestic and electro-medical apparatus is being shown by Ideal Home Electrical Appliances, Ltd., including " Alpine " sunlight ultra-violet-ray apparatus, radiant light and heat apparatus, portable violet-ray high-frequency sets, vitalators and ozonisers, hair dryers, electric heating blankets and pads, vibrators, sewing-machine motors, electric saucepans, hot plates, convertible holders, fans, hirum suction cleaners and polishers, parlour 'phones and immersion heaters.

On the stand of Belling & Co. a wide range of " Belling " fires is displayed, both for domestic and industrial purposes. Amongst the domestic range are some portable designs in several beautiful finishes, and also a wide range of imitation coal fires fitted with a realistic flickering flame effect. For industrial purposes there are totally enclosed and fireproof air warmers, pipe heaters and electric hot-water radiators. A series of electric cookers is also on show, ranging from the well known " Baby Belling " cooker up to full-size models. There are also some electric water heaters suitable for fixing into any existing tanks or cylinders, and for use in conjunction with the ordinary domestic hot-water system. Practical demonstrations are given of the new " Parmotor " relay which is on show for the first time. This is for automatically controlling electrical circuits and is claimed to be more reliable and more flexible and cheaper than a time switch. It has a very wide application, including the thermostatic control of electric water heaters, cookers, electrically heated rooms, street-lighting control, shop-window lighting, night signs, traffic control, and so on.

Messrs. Beatty Bros., Ltd., are exhibiting the " Beatty " electric washer, complete with a reversible wringer. This machine is fitted with a positive agitator which is claimed to be the latest and fastest type of mechanism for the thorough cleansing of clothes. The machine may be connected to an ordinary electric light socket, and costs less than an electric iron to run. An ordinary household washing can be completed, it is claimed, in an hour, with only the aid of hot soapy water. Ball-bearing castors allow easy movement of the machine, which does not take up much room. The reversible wringer can be swung and locked in seven different positions, and is fitted with reversible rubber-rollers. There is also a quick-release which instantly releases the pressure on the rollers.

On the stand of Messrs. Falk, Stadelmann & Co., Ltd., fit-

Fig. 6.—" Jackson " No. 24D. Cooker; 19.1 kW.

tings for electric light in the prevailing style form the keynote, but comprehensive arrays of " Nova " and " Efesca " switches, " Hitest " cable, &c., " Ideal " table apparatus, and " Efescaphone " wireless sets give added interest.

On the stand of the Yorkshire Electrical Detonator Co., Ltd., may be seen samples showing various stages in the manufacture of electric fuse detonators. There are also exhibits of submarine electric fuse detonators, electric firing exploders, connecting cables, wire, and testing instruments.

Messrs. PICKERINGS, LTD., are displaying an electric passenger lift of the push-button control type which has a capacity of four persons and runs at 100 ft. per minute. An electric service lift and a directly-coupled electric friction hoist, 3¼ cwt., are also shown.

Among the electrical items which are to be found "burried" in the exhibits of non-electrical firms may be mentioned a Baker Perkins electric oven on the stand of HUNTERS THE BAKERS, LTD. This is a portable 2-deck skip-type peel oven with a baking area on each deck of 6 ft. by 5 ft. The loading is 27 kW. It is interesting to note that an oven of this type has been installed on H.M.S. Cumberland, and that two others are being erected on H.M.S. Medway.

"Artofex" electric ovens may also be seen on some of the stands, including that of Messrs. JUVELS, which is equipped with electric ovens, hotplates, cake mixers and whisking machines.

Exhibits which may be seen on the stand of Messrs. G. & J. WEIR, LTD., include a "Multiflow" feed-water heater; a "Monotype" air pump, 16 in. by 9 in. by 12 in.; a two-throw pump, 7 in. by 7½ in., electrically driven, 16,300 gal. per hour at 75 r.p.m. against 80 lb. per sq. in.; a two-throw pump, 4 in. by 4½ in., electrically driven, 4,250 gal. per hour at 100 r.p.m. against 80 lb. per sq. in.; a 10-ton evaporator with feed regulator and brine ejectors, 10 tons per 24 hours.

Messrs. DAVIDSON & Co., LTD., have an interesting display of "Sirocco" products, including a cupola fan capable of supplying adequate volumes for cupolas, furnaces, &c., up to 30 in. w.g.; a dust fan for handling dust of every description; and a narrow-width dust fan, designed for use with extensive ductwork in which frictional resistance up to 12 in. w.g. has to be overcome. There is also a working model of a Davidson patent flue dust collector, S.P. type, and one of a "Sirocco" dust collector suitable for dealing with dust of every description.

Messrs. H. C. SLINGSBY has on show a range of automatic electric trucks, including load-carrying trucks; elevating platform trucks for loads up to 2 tons; lifting-tiering trucks up to 75 in. for loads up to 2 tons; trackless-tractor-trailer-truck-trains; and industrial engines, trackless and for railways.

Some good examples of electro-plating work are being shown by Messrs. SAMUEL ALLEN & Co., LTD., who are also displaying "Luminad" electric sign lanterns.

Among a number of firms who have displayed small electricity generating sets of the country-house lighting type are MESSRS. ROBSON & COLEMAN, who are showing a 6-kW crude-oil Crossley engine complete with a Holmes dynamo and switchboard, &c., and also a 1½-kW petrol set. The cost of fuel for the crude-oil set is claimed to be exceedingly low, considerably below ½d. per unit. On this stand are also to be seen an electric drill, a sheep shearer and a horse clipper, an all-electric wireless set, a sun-ray medical lamp, and some apparatus suitable for country-house use. A feature of the stand is the ceiling panel lighting employed, and another point of interest is the low-temperature ceiling panels designed for even distribution of heating throughout buildings, everything being concealed.

Included in a representative series of stationary and marine oil engines and electric generating plant exhibited by MESSRS. PETTERS, LTD., is a controlled automatic 5-kW electric lighting set with an 8-h.p. Petter surface ignition oil engine. This set runs on crude fuel oil, and the running cost is said to be approximately one halfpenny per unit. A special starting motor is provided, driving the engine crankshaft through reduction gearing, and the whole is carried on a heavy cast-iron bedplate. The necessary heat for the ignition of the first charges in the cylinder is provided by means of an electric heating plug which serves until the vaporiser in the cylinder head has attained a sufficient temperature to carry on ignition automatically. There is also in operation a Petter "Atomic Diesel" high-compression, cold-starting, airless and springless-injection oil engine, a four-cylinder unit of 100 h.p. The engine operates on the improved two-stroke cycle, and its design is characterised by its extreme simplicity.

FILTRATORS, LTD, are showing a complete "filtrator" plant for dealing with boiler feed water, including the "Filtrator," together with the continuous blow-down and heat-recovery apparatus. The filtrator treatment is entirely non-chemical, and it will deal, it is claimed, with any type of water and also water of varying hardness.

BAKELITE, LTD., are showing a variety of mouldings made from bakelite moulding materials, and also samples of bakelite laminated sheet for switchboards, &c., bakelite tubes and rods for transformer and switchgear insulation, and bakelite varnish for coil-insulation, &c.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., and its associated companies have a particularly interesting show at the Palace of Engineering. Their stands are surrounded by a scale model of a 66,000-V overhead transmission line. In the industrial heating section they have displayed a 27-kW and a 9-kW electric furnaces by the Birmingham Electric Furnaces, Ltd. These furnaces are designed for general heat-treatment purposes, and are shown working up to a temperature of 1,000 deg. C. There is also a 3.75-kW magnetic steel-hardening furnace by Wild-Barfield Electric Furnaces, Ltd., a Vickers-Armstrong hardness-testing machine, an 18-kW immersion-type electric water heater for steam raising by A. Reyrolle & Co., Ltd., and miscellaneous heating apparatus, such as solder bolt heaters, babbitt metal pots, and so on.

The Colliery Machinery Section of the company's stands is equipped with a 2,000-g.p.m. centrifugal pump by Mackley and Co., with a directly-coupled high-torque squirrel-cage motor by Veritys, Ltd., and Ellison control apparatus, working under full-load conditions in conjunction with a waterfall. Other items include an endless rope hauler by John Wood & Sons, Ltd., incorporating a 22½-h.p. slip-ring induction motor and a flameproof mining-type switch panel by the English Electric Co., Ltd., and an airbreak flameproof drum-type reversing controller with independently mounted resistances by Allen West and Co., Ltd.; an explosion-proof portable gate-end sub-station designed for the remote control of coal face machinery; a working model of an a.c. electrically-operated geared winding engine with a bi-cylindro conical drum by Robey & Co., Ltd.; and a working model of a mine-ventilating installation by Davidson & Co., Ltd.

In the Company's General Industrial Machinery Section may be seen in operation an electric shearing machine by Holman and Co., a portable Reavell compressor set, a 3-h.p. Brook-Igranic ventilating fan with press-button control, a "Power Factor" demonstrating model by means of which the effect of power-factor correction in an electrical circuit is shown, a model variable-speed chain drive gear box by P.I.V. Chain Gears, Ltd. (433/1,300 r.p.m.), and portable electric tools and tools operated by flexible shafts by Vidal Engineering Co., and Flextol Engineering Co. Reference should also be made to an ingenious device, Synchro-Vane, which consist of two motors, each fitted with a four-bladed propeller revolving in the opposite plane at a speed of 1,200 r.p.m., thereby producing a peculiar optical effect.

Situated in the tower entrance of the Palace of Industry is a group of the company's exhibits known as "Switchcraft Corner." One stand depicts in a pleasing modern setting the domestic uses of electricity for lighting, cleaning, heating, kitchen work, cooking, ironing, &c., and another stand is devoted to four large tableaux with wonderful lighting effects. These tableaux depict picturesque scenes typifying illumination from early days, the coldness of refrigeration, the modern method of dirt removing and the perfect control of electric cooking. A rest room is beautifully lighted with artificial daylight, and embodies an information bureau. Another exhibit, "Rooms of To-day and Yesterday," is impressive in showing how the "dowdy" rooms of a few years ago—still so common a feature in many homes—may be made artistic and comfortable with modern furnishings and electric fittings. That ultra-violet rays have all sorts of practicable, but unlooked for, applications is being demonstrated in a fluorescence cabinet.

Visitors who like to speculate on "How it Works" will have full scope in such exhibits as "The Mystery Wheel" and "The Mystery Lamp," which are each operated by a photo-electric cell.

Legal.

The Marconi Company's Royalties Appeal.

THE second case in which Marconi's Wireless Telegraph Co., Ltd., is appealing from a decision of the Comptroller-General of Patents in respect of the grant of compulsory licences for the manufacture of wireless receiving sets and valves came before Mr. Justice Luxmoore in the Chancery Division on May 15th. The Order made by the Comptroller-General directed the Marconi Company to grant a licence to the Loewe Radio Co. to manufacture in this country triple and double valves, paying royalties of 10s. and 7s. 6d., respectively; in other forms of multiple valve the royalty was to be calculated on the basis of 5s. for the first, and 2s. 6d. for each additional unitary valve.

Sir DUNCAN KERLY, K.C., for the appellants, said that the Loewe Co. was incorporated in 1927, and had an issued capital of £50. It was the creation of a large German radio company. It was formed to carry on business if it got a licence. If the Judge refused the licence its *raison d'être* would disappear.

Mr. CRIPPS (for the Loewe Co.) denied this, stating that the company manufactured other things.

Sir DUNCAN said the company had acquired a factory with money borrowed from the German company. The German company had an invention in which all the material parts of a three-valve receiving set were contained in one envelope. It was in effect one valve.

Mr. CRIPPS said there had to be coils.

Sir DUNCAN said the Comptroller described the valve as a "very remarkable and beautiful example of ingenious design and high-class workmanship." The Marconi Co. never refused applicants a licence. There was correspondence between them, and when it was pointed out that the Loewe Co. would need a licence for more patents than they had mentioned they said they were not prepared to take more, and they would apply for a compulsory licence, which they did without further ado. He contended that there was absolutely no case for interference by the grant of a compulsory licence on the ground that a licence had been refused. He maintained that the Comptroller was so captured by the invention that his judgment was overborne, and he thought he must do something for its use in this country.

The Judge was handed a sample valve. Mr. Cripps explained its working, and his Lordship considered that it was "a beautiful piece of work."

Sir DUNCAN contended that on the written evidence before the Comptroller there was absolutely no case for proceeding further. Verbal evidence was given by Mr. Loewe, who said the invention was protected by British letters patent, that the valve was made under licence from the Telefunken Co. at a royalty in Germany of 1s. 3d., and was sold there at the equivalent of £1 19s. There was an enormous sale and a substantial export. It could be put on the British market, allowing for a royalty of 10 per cent. on the wholesale price, at £2 10s., at which it was estimated to supply a demand from half a million people. Mr. Loewe also undertook to transfer the export trade to British Colonies from Germany to this country. But there was nothing before the Comptroller or in his capacity to control to provide for any limitation of the German export trade, and the licence had been granted without any limitation. The Comptroller assumed that the invention was covered by patents, but he had no materials for judging whether the latters patent were worth anything. The case had proceeded on unverifiable assumptions. The Comptroller had assumed that to prevent the patent being worked here was to prejudice the establishment of a new trade or industry. Also, he said that the demand of a royalty high enough to prevent the new article appealing to a new group of purchasers was prejudicial within the meaning of the Act. One aspect that had been lost sight of was the effect of the invention on existing manufacturers under the Marconi patents. There was no condition in the licence limiting manufacture to any particular article, and there was no minimum royalty. He further complained that the Comptroller had fixed the royalty without having any means for deciding what a reasonable royalty would be. He disputed the Comptroller's view that the Loewe Co. desired to establish a new trade here. It wanted to enter an existing trade with a new variety of article which without any preference would enable it to become a formidable competitor. Counsel read the evidence which was given before the Comptroller, and said it was to be noted that though the evidence was that there was a great and growing demand in Germany for the Loewe receiving set, there was no suggestion that the trade in ordinary valve sets was continuing there. There was no evidence that the Loewe Co. was refused a licence, or that the Marconi Co. was at all unreasonable. What did appear was that the speculation in finding a new class of purchaser had no basis of proved probability. What was certain was that the grant of a licence on preferential terms would enable the applicants not only to destroy the existing licences of the Marconi Co., but also enormously to reduce the royalties which it had been receiving. For the suggested royalty of 10s. on the Loewe triple valve there was no basis whatever. Counsel then read the decision of the Comptroller-General.

When the hearing was resumed on May 16th, Sir DUNCAN KERLY said the Comptroller had stated that there was a potential demand for the new apparatus, but this was not provided for by the Act. The establishment of a new trade or industry was not, as the Comptroller seemed to think, the introduction of some variation of something which was already an article of commerce. The Loewe Co. merely desired to enter an established trade with a new variety of attractive goods. There was no limitation in the licence to the manufacture of cheap sets, and there could be no possible case for granting a general licence. The Marconi Co. was desirous of the opportunity of putting the Loewe valves on the English market, and was prepared to discuss terms, but it had never even had a proposal made as to the extent of the limitation of the licence. It was by the protection of the Marconi patents that the English trade had been built up. The Loewe Co. would be in a position to swamp that trade. The only limitation in the licence was that 50 per cent. of the factory costs should be incurred in this country.

Mr. STAFFORD CRIPPS, K.C., on behalf of the Loewe Co., said there was a fundamental distinction between this case and the Brownie case. The position of the applicants in this case was that they were the owners of 12 British letters patent. The Crown had granted them a monopoly, and he submitted that it must be assumed that the Crown did that because it was thought that it was desirable that a new manufacture should be established in this country. It was common ground that the monopoly could not be exercised in this country without a licence and unless the monopolies were worked within a certain time the patents were revokable. The Marconi Co. did not manufacture, and their licencees could not manufacture, the Loewe valve, and if the applicants were not allowed to manufacture the article here the country must inevitably go without it. It could not be for the good of the country that for ten years or more it should be definitely deprived of the use of an article which was sufficiently meritorious for the grant of 12 monopolies in respect of it, whereas other countries in the world were free to use it. The licence included a number of clauses for which he never asked and which he would be glad to see omitted, the 10s. royalty, for instance; it was left to the discretion of the Comptroller, and he settled the matter. The Loewe Co. asked for a licence under five Marconi patents. They were told they could only have it under 13. That, he submitted, was a refusal to grant a licence. Even if he was wrong about that, he contended that the conditions which the Marconi Co. sought to impose amounted to a refusal to grant a licence on reasonable grounds. The Loewe Co. did not claim more for its three-valve set than any other three-valve set. The merit of the invention was that they could make it at a quarter of the price of an ordinary three-valve set. If the public was going to be charged a royalty of £1 17s. 6d. it would largely lose that benefit.

The hearing was concluded on May 17th, when Mr. CRIPPS, K.C., in further argument, said the Loewe valve was more more than a valve; it was a receiving set, and he contended that its manufacture in this country was the establishment of a new trade or industry in the fullest sense of the British patent law, and a factory had been established in London. It was impossible to say that the valve was a mere improvement on, or alternative to, an ordinary valve. The fact that its production required special machinery went to prove that the manufacture of the article was a new trade or industry. If his Lordship did not accept this suggestion, then counsel contended that it was an existing trade. In that case the Loewe Company's trade was clearly being prejudiced. He could not imagine a case in which there was more prejudice to trade than when one had a factory for the production of an article and was prevented from producing it. It was impossible commercially to put the article on the market with such a high royalty as 37s. 6d. There had also to be considered the prejudice to dealers in wireless who would be unable to enjoy the accession of business which would result, and the prejudice to the trade of the country. Moreover, it was contrary to the public interest to refuse the Loewe Co. a licence on reasonable terms. When considering the question of royalty one had to consider what the Marconi Co. had reasonably expended on acquiring its patents, and also the capacity of the public to pay. In Germany in the year prior to the hearing of the case the royalties paid to the Telefunken Company amounted to £35,000, the amount of royalty being 1s. 3d. a set. Here the proposal was 10s. per set, and in the export trade alone, which Mr. Loewe had undertaken to transfer to this country, a very large sum would be payable to the Marconi Co. that it did not now receive. They would be made a present of 8s. 9d. a set. If a royalty of 37s. 6d. had to be paid, it would be impossible to bring the export trade to this country. The Loewe Co. was quite prepared to pay a reasonable minimum royalty, It was also willing that the licence should be limited to the particular form of multiple valve that had been shown, and to any reasonable limitation as regards price. It had been advertised at £3 3s., and that would quite likely be reduced when the factory got fully going.

The JUDGE suggested that it might be possible for the parties to agree a form of licence.

Sir DUNCAN KERLY said he was unable to do that on his present instructions, but he was authorised to say that his clients fully anticipated that there would be a licence, and they were prepared to grant one.

Mr. CRIPPS said that the only difficulty arose from the difficulty of getting instructions.

The JUDGE said he hoped to be able to deal with the matter on the first day of the next sittings. If the parties reached an agreement in the meantime it would not be necessary for him to give his decision. The suggested terms of the agreement were written down and handed to his Lordship, but were not disclosed.

Sir DUNCAN KERLY declared that the whole basis of the case was that a gentleman desired to compete in an existing flourishing trade by operating a cheaper article in competition with articles already sold in the trade. The Marconi Co. denied that that was the establishment of a new trade or industry, or that it was in the public interest he should do so.

Mr. STAFFORD CROSSMAN, for the Crown, said he desired to adopt the observations of the Attorney-General in the Brownie case. The only point which did not arise in the Brownie case was as to the meaning of the expression "establishment of any new trade or industry in the U.K." In this case he suggested that "trade" could not be limited to a particular improvement in trade or detail of manufacture. It appeared to be a question of fact whether this particular work which the Loewe Co. was doing came within the meaning of new trade or industry in the sub-section of the Act.

His LORDSHIP, at the conclusion of the arguments, reserved judgment, and said he would give his decision in both this case and the Brownie case together.

The Gasfilled Lamp Patent.

As was reported in our last issue, this case was concluded on May 14th, when the British Thomson-Houston Co., Ltd., was granted a two-years' extension of its gasfilled lamp patent.

In his concluding address, Sir ARTHUR COLEFAX, K.C., for the company, said that he had no objection to a condition being imposed as part of an extension order making provision for the case of a manufactory established in this country for the manufacture of gasfilled lamps during the interval between the expiry of the patent and the date of the grant of the extension. But he did object to the insertion of any condition which would have the effect of franking the import of foreign-made lamps into this country during the interval. It was not the fault of the applicants that there was any interval. Dealing with the arguments of counsel for the opposition, Sir Arthur said that the patent could not be properly worked during the war. When the applicants and

their licencees became decontrolled it was only a few months before small gasfilled lamps were put on the market. But for the war the lamps would have been put on the market in 1915. In those circumstances two years was not an adequate period for the prolongation of the patent, which ought to be extended for the full period of the war. An attempt had been made to show that instead of losing by the war the applicants had gained. But even with regard to the large lamps, the evidence was that there was an unsatisfied demand for them in the war period. Owing to their restrictions, the applicants could not make a manufacturer's profit. They had to import lamps, and they were not allowed to import freely. The fact that 70 per cent. of the gasfilled lamps sold were small lamps showed that this type of lamp was preferred to vacuum lamps. There was no evidence that the patentees had done anything improper with regard to licences. They had always been ready and willing to grant licences on suitable terms. Counsel concluded by asking for a prolongation of the patent for a period of four years.

Mr. Justice Luxmoore, in giving judgment, said it was sufficient in the majority of such cases for the manufacturer to show that the working of the patent had been prevented or interfered with by the war. In this case the applicants alleged loss and damage by the war. They did not suggest that they had not made substantial profits out of the invention during its life, but that a large part of the life of the invention had been cut off by the war. The invention was no doubt an important one, of far-reaching effect. The opposition was based on four or five grounds. First, it was denied that the applicants had suffered loss or damage by reason of the war; secondly, that they had since the war recouped themselves for any loss sustained during the war; thirdly, that the applicants had in fact been adequately remunerated; fourthly, that the application had been put forward with a lack of candour. It was said that they charged too high a price for lamps, that they allowed larger discounts to those traders who agreed to take other non-patent articles from them, and that there had been a refusal to grant licences, and generally that applicants had abused their monopoly rights. What were the facts? The patent was granted in 1913. No lamps were manufactured under the patent before the war. The lamps were first put on the market in 1915. From the outbreak of war the applicants were engaged in making machinery and apparatus for the forces of the Crown. In 1915 applicants' works became a controlled establishment, and so continued till late in 1919. The figures of the output of the applicants and their licencees showed clearly that the output was affected during the war. Mr. Gray, in his affidavit, said that the lamps made during the war were lamps of large size required by the Government, and it was impossible to manufacture small gasfilled lamps which formed the bulk of the requirements of the public. He had no hesitation in accepting the evidence of Mr. Gray where it differed from the evidence of the opposition. He was satisfied that there was material interference with the normal life of the patent, due entirely to the war and the restrictions the war imposed. Next it was said that the loss or damage had been more than recouped since the war. He could not see there was any real ground for such a suggestion. Suspended demand did not apply in his view to an article like an electric lamp, which had a comparatively short life. It was next said that the applicants had been adequately remunerated. It was not his province to consider that; the only question was whether the life of the patent had been shortened. If it had the patentee was entitled to an extension. The next objection was to the applicants' methods of trading and the application to the Court. It was said that the figures given did not enable the Court to see what profits had been made. He had not got to consider whether the remuneration was adequate or otherwise, but whether a material part of the life of the patent had been lost to the patentee. He acquitted the applicants of the charge of want of candour. He had no hesitation in saying that the evidence before the Court supplied by the applicants was sufficient. Next it was said that the prices charged were too high. He saw no ground for that. Public demand had been large, and was undoubtedly increasing, and if there were real grounds for the allegation one would expect evidence of a specific nature to support it. The larger discounts, he considered, were not unreasonable in the circumstances, and in his view the so-called "municipal" contracts did not fall within Section 38 of the Act. They were contracts entered into with the Electric Lamp Manufacturers' Association, and not with the applicants at all. The next matter was that applicants had refused to grant licences on proper terms. On the evidence before him the only refusal to grant a licence had been in the case of one man, and after the evidence of Mr. Gray with regard to that he saw nothing unreasonable in the refusal. In considering the question of extension, he was bound to take into consideration that it must necessarily take some time to put the articles made under this patent on the market commercially, and that during the war period some work was done on the patent, mainly, it was true, in connection with large lamps; further, he might take into consideration the fact that the profit on those lamps was probably higher than it would have been on small lamps. Further, the company during the war was making large-sized lamps and was gaining valuable experience. After very careful consideration, he had come to the conclusion that the proper period for extension was two years. In coming to that conclusion he had been assisted by the view expressed by Mr Crossman, on behalf of the Comptroller. In conclusion, his Lordship said that the applicants must use their best endeavours to obtain the registration of licences forthwith. There would be no order as to costs.

Theft of Electricity.

A case of an unusual nature was heard at the Old Street Police Court, London, on May 14th, when Reginald Hughes, Stepney, was sentenced to six months' hard labour for the theft of electricity. The evidence showed that Hughes was employed by a man who lived next to him. His employer noticed that his electricity bill had become abnormally heavy, and also that when his supply was switched off the defendant's lights went out. It was then discovered that wires had been run from the meter through the dividing wall into defendant's house.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Proposed Technical Society for Meter Engineers.

It would be a thousand pities if the juniors were to feel that their interests were being neglected.

It is without doubt desirable that they should be able to participate freely in any activities organised for the advancement of metering knowledge and kindred subjects. Danger lies, however, in any tendency to scattered effort, as against unity. The late M.E.T.A. did exceedingly good work, and its chief asset was unity of effort. As is known, it became transformed into the Meter and Instrument Section of the I.E.E. What good object would now be achieved by causing disaffection? Why revive arguments on points that were considered in detail and at length during the months preceding the transformation, and were finally settled by a decisive majority approaching unanimity?

The Meter and Instrument Section does (with greater authority and effect) all and more than the old M.E.T.A. did, with the one exception of the publication of the M.E.T.A. *Proceedings*. The quarterly publication of those *Proceedings* used to cost organised effort and, above all, money. A monthly publication would cost still more of both. It is exceedingly doubtful if a new society could support the necessary sustained effort and cost, especially after the first eager enthusiasm had evaporated.

The M. & I. Section holds six meetings during the winter session. Juniors, who are not members of the Institution, are always welcome as visitors. The papers read are separately available in the form of advance copies. The fact that the papers are of a high standard should react to the advantage of the younger men, rather than to their detriment. Papers may, if there is a demand, be read at the I.E.E. local centres in the provinces, thus discounting the disadvantage of the inaccessibility of the London meetings. The late M.E.T.A. was never able to afford this facility, nor, I think, could any new society.

The younger members of the meter and instrument section of the industry will find, I am sure, that it will be best to take the long view, and that their ultimate interests will be best served if they give active support to the M. & I. Section of the Institution and cast out of their minds any idea that the seniors, even inadvertently, are keeping aloof from them. On the contrary, the senior men are only too willing to do all in their power to help the younger men; therefore, it would be a great mistake to weaken the bonds that exist, and to establish a definite state of separation by the setting up of a new society. Unity has been gained at some cost: try to retain it.

E. W. Hill.

London, *May 13th*, 1929.

An Old Problem—from a New Point of View.

Will you permit me to comment on a part of the article on the above subject in your issue of May 10th?

"Ric" states, *inter alia*, that "It is the easiest thing in the world to obtain a diploma . . . from a correspondence school."

Within 24 hours of that statement being published I received a letter from a student, referring to "Ric's" article, in which he states: "If this goes unanswered it will be rather discouraging after a chap has put in four years' evening swotting to be told that nothing is easier." I quote in all his bald simplicity of terms.

It is conceivable that the author has taken a diploma from a correspondence school; he may, for all I know, have qualified for and taken his diploma from these schools and found it the easiest thing he had ever done. This merely means that it was easy to him personally and by inference that he is one

of those exceptional people to whom nothing in the way of scholarship presents any difficulty. Dr. Young, of Rosetta Stone fame, was elected an F.R.S. before he was 20, but surely this does not imply that it is an easy job, and that anyone can do it? Young was an exception, and must be ruled out when considering average cases.

I do not know if "Ric" includes these schools among the four probables "that attempt to carry out the promises of their advertisements," but whether he does so or not, it is certainly by no means an easy job to obtain the I.C.S. Diploma. In one of our courses in electrical engineering there are 112 separate instruction papers, each being a pamphlet of from 30 to 80 pages, and each student has to pass an examination on each paper before he can take the final examination for the diploma. This means that a man has to pass not one, but 113 examinations.

I am unable to see any point in the fact that this work is done in the students' home, and certainly an average time for each test would be five hours' concentrated work on the question paper alone without considering the time spent in studying the instruction matter. It by no means follows that the final examination is taken by the student in his own home. We have an arrangement by which a student may take his final under supervision, and the supervisor has to make a declaration that the conditions of the examination, the time, and so on, have been fully observed. In every case of our students in India, we insist upon this supervision. Apart from this, a large percentage of our students are reading for one of the examinations held by one or another of the public examination bodies—the various professional institutions, the examinations of certain universities, and so on. These men do not obtain a diploma at all from us, but merely a notification that they have received a percentage of marks for the work on the various subjects of their course.

The author states that "The thing can be done by private study, but a tutor of some sort is necessary." I submit that the thing is being done by private study by these men, and that we represent the tutor to whom they can turn, and to whom they do turn, by writing about their difficulties and receiving our explanation. Further, the course is systemised, and the student works to the system.

We should welcome a Central Board of Technical Education, and would willingly co-operate in any scheme which would tend to raise the standard.

I am taking the liberty of enclosing a couple of instruction papers in order that you may see for yourself the scope of our work on the more elementary principles, and if "Ric" cares to call and see me any day during business hours, or will make an appointment to meet me outside business hours, I shall be happy to show him the system in working order, and, I hope, convince him that his statement is exaggerated. I know that correspondence schools have supplanted the mother-in-law in certain types of humour, but at any rate some of them are doing work which cannot be handled by any other school, or college.

Francis Thos. Fawcett,

Chief Examiner, School of Electrical Engineering, International Correspondence Schools, Ltd.

London, W.C.2, *May 13th*, 1929.

[The instruction papers have been received.—Eds. Elec. Rev.]

The Compulsory Earthing of Prepayment Meters.

If Mr. A. J. Abraham knows as much of electrical matters as he knows of the relationship between husband and wife, his letter should not be taken too seriously. He writes: "In the tenth case, the lady of the house might receive a little shock, when she would probably *give* 1s. to 'hubby' to put in the meter so that he could get one too."

Mr. Abraham can't be married, or he would not suggest such a thing. What might happen is that the lady of the house would say to "hubby"? "I have no change, so put a few shillings in the meter, or you will not get any dinner."

Leonard F. S. Sington.

Liverpool, *May 17th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

28,492. "Vibrating electric motor." Traylor Vibrator Co. November 2nd 1926. (280,194.)

31,410. "Regulation of control of alternating currents." G. L. Porter and Ferranti, Ltd. November 22nd, 1927. (310,296.)

31,773. "Manufacture and production of electrodes for Edison accumulators." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). November 25th, 1927. (310,383.)

34,940. "Potential supply means suitable for use in wireless receiving apparatus." B. D. Feild and T. C. Standbrook. December 23rd, 1927. (Addition to 293,114.) (310,299.)

1928.

1,800. "Electric switchgear." British Thomson-Houston Co., Ltd., M. C. I. Hunter, and F. L. Fletcher. January 19th, 1928. (310,387.)

2,027. "Electricity meters." Siemens Bros. & Co., Ltd., and C. R. Riber. January 21st, 1928. (310,390.)

2,120. "Electrically-operated and controlled means for operating the barriers at railway crossings." A. U. Westfelt. January 23rd, 1928. (310,304.)

2,411. "Loud speakers and the like." G. D. Lucas. January 27th, 1928. (310,441.)

2,610. "Wireless telegraphy and telephony, and aerial systems therefor." C. S. Franklin. January 26th, 1928. (310,451.)

2,639. "Electric remote control systems." Compagnie des Téléphones Thomson-Houston. January 27th, 1927. (284,296.)

3,310. "Primary batteries." J. W. Manley. February 2nd, 1928. (310,570.)

3,343. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. E. Beale February 2nd, 1928. (310,574.)

3,344. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. February 2nd, 1928. (310,575.)

3,449. "Electrical condenser." Leclanché Soc. Anon. February 12th, 1927. (284,079.)

3,682. "Amplifiers for electric circuits." Soc. Industrielle des Téléphones. February 5th, 1927. (284,977.)

3,807. "Telephone instruments." Siemens Bros. & Co., Ltd., and W. E. Goodwin. February 7th, 1928. (310,579.)

4,019. "Thermal electric switches." N. Dennes and Associated Electrical Industries, Ltd. February 8th, 1928. (310,581.)

4,075. "Means for indicating or recording, also applicable to electrical relays." H. J. Buchanan-Wollaston. February 9th, 1928. (310,582.)

4,244. "Mercury or the like switches." British Thomson-Houston Co., Ltd., and C. G. Garton. February 10th, 1928. (310,585.)

4,524. "Clamp for electric current-conducting wires." G. Hammermann. February 14th, 1927. (285,379.)

4,786. "Make-and-break devices for use in electric ignition systems of the combined induction-coil and magneto-ignition type for internal-combustion engines." British Thomson-Houston Co., Ltd., L. Griffiths, and C. J. Morton. February 15th, 1928. (310,592.)

4,811. "Electrical relays." T. W. Ross and Associated Electrical Industries, Ltd. February 15th, 1928. (310,593.)

4,875. "Metal clips and like fastening means for electric cables." J. McCallum. February 16th, 1928. (310,595.)

5,109. "Electric switches." W. J. Charles and A. Watson. February 18th, 1928. (310,597.)

5,923. "Electric lamps." H. S. Cooke. February 25th, 1928. (310,605.)

5,950. "Headlights for vehicles." A. H. Ehrhard. February 25th, 1928. (310,606.)

7,987. "Control systems for electric motors." E. N. Bray, Ltd., and E. N. Bray. March 15th, 1928. (310,615.)

8,075. "Electric connectors." J. B. Taunton and Ranton, Ltd. March 16th, 1928. (310,620.)

8,316. "Thermionic valve arrangements." Marconi's Wireless Telegraph Co., Ltd. March 17th, 1927. (287,463.)

8,795. "Production and application of plates for electric condensers and the like." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). March 22nd, 1928. (310,625.)

8,967. "Electrical relay devices." Westinghouse Electric and Manufacturing Co. March 25th, 1927. (287,578.)

9,257. "Adjusting device for the driving systems of electric measuring instruments of the induction type." Landis & Gyr Soc. Anon. April 25th, 1927. (289,375.)

11,724. "Electric switches." D. Gueron and S. Danon. April 20th, 1928 (310,650.)

12,340. "Wireless direction-finding apparatus." Siemens Bros. & Co., Ltd., S. H. Long, and M. Hodge. April 27th, 1928. (310,658.)

12,771. "Lighting arrangements for power vehicles." R. Frev. May 2nd, 1927. (289,813.)

14,397. "Electric radiators." L. Canard. June 4th, 1927. (291,441.)

14,877. "Telegraph printers." L. C. Eastern. May 21st, 1928. (310,677.)

15,665. "Electromechanical resonance device for distant control." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz and Soc. l'Action à Distance. June 14th, 1927. (Addition to 277,024.) (292,120.)

15,686. "Electrical heating of furnaces." Dr. W. Hammer. June 2nd, 1927. (291,450.)

20,009. "Knee-control mechanisms for portable electric sewing machines." W. Fairweather (Singer Manufacturing Co.). July 10th, 1928. (310,714.)

21,344. "Telephone apparatus." R. L. J. Laurent, De La Vide le Roulx. July 22nd, 1927. (Addition to 274,898.) (294,489.)

21,709. "Arc-welding electrode holders." L. Renault. January 5th, 1928. (303,490.)

23,278. "Speed-control systems for electric motors." British Thomson-Houston Co., Ltd. March 26th, 1928. (308,674.)

23,606. "Electric lamp for illuminating rooms or containers filled with explosive gases or liquids." J. Beckmann. August 16th, 1928. (310,731.)

24,415. "Automobile headlights." H. Harper. August 24th, 1928. (310,734.)

24,859. "Process for the economical treatment of mixtures containing hydrocarbon and nitrogen in the electric arc." Soc. of Chemical Industry, Basle, and H. Andriessens. August 29th, 1927. (296,355.)

25,618. "Method of and apparatus for removing insulation from insulated wire." F. M. Van Gelderen. November 4th, 1927. (299,866.)

26,202. "Electric transformers." International General Electric Co., Inc. September 14th, 1927. (297,087.)

32,102. "Long-distance cable for four-wire working." Siemens-Schuckertwerke Akt. Ges. November 19th, 1927. (Addition to 294,570.) (300,899.)

96,195. "Illuminating arrangements." H. M. Rasmussen. December 16th, 1927. (302,159.)

1929.

1,311. "High-frequency apparatus." W. Otto. January 14th, 1928. (304,148.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 15th:—

B.A.A. No. 500,089. Class 1. Acid for accumulators and batteries.—F. W. Berk & Co., Ltd., 106, Fenchurch Street, E.C.3.

Faraday Radio Gramophones (lettering and design). No. 497,129. Class 8. Gramophones.—Faraday Sound Wave Electric Gramophone Co., Ltd., 8, Bridewell Place, E.C.4.

Amplion Lion. No. 498,850. Class 8. Loud speakers.—Graham-Amplion, Ltd., Slough.

Rabco. No. 501,084. Class 8. Radio-telephonic apparatus and parts thereof, &c.—W. Vincent, 227, Pentonville Road, N.1.

Passport. No. 501,135. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof, &c.—Hart Collins, Ltd., 38a, Bessborough Street, S.W.1.

The Forum (lettering and design). No. 501,291. Class 8. Radio-telephonic apparatus and parts thereof, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Neolux. No. 500,988. Class 15. Lamp shades made of glass, &c.—Louis Dernier & Hamlyn, Ltd., 23, Newman Street, W.1.

Sunblaze. No. 501,261. Class 18. Electric and gas stoves and radiators.—Berry's Electric (1928), Ltd., 85-87, Newman Street, W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHTON-UNDER-LYNE.—Two schools (560 places), for the borough E.C.; F. W. Bromley, clerk.

AYR.—Electric lighting installation, district fever hospital, Old Cumnock, for Ayrshire C.C.; J. E. MacEwan, consulting engineer, 62, Robertson Street, Glasgow.

BARNSLEY.—Premises, Queen Street; F. W. Woolworth and Co., Ltd. Extensions, mill, Old Mill Lane; Yorkshire Paper Mills, Ltd. Workshop, Sheffield Road; W. Goodyear & Sons.

BEDFORD.—Depôt extensions (£21,000); borough engineer.

BEDHAMPTON.—School (350 places); Hampshire Education Committee.

BEXHILL-ON-SEA.—Concert hall, &c. (£11,650), for the T.C.; borough surveyor.

BILSTON.—High school for girls (£44,250), with electrical and heating work; Col. S. C. Lowbridge, architect, Stafford; J. & F. Wootton, Ltd., builders, Bloxwich.

BIRMINGHAM.—Museum, Cannon Hill (£8,000); city engineer.

BLYTH.—School (480 places), for Education Committee.

BOGNOR.—Business premises, High Street and London Road, for Timothy White, Ltd., Chandos Street, Portsmouth.

BRADFORD.—Reconstruction scheme, Sharman's warehouse, Thornton Road; city engineer. Elementary school, Eccleshall estate; extensions, Undercliffe girls' school and Wyke Modern School; city architect. Girls' grammar school, Royde estate; governors. School at Brierley, city architect and trade contractors.

BRISTOL.—Aerodrome, Whitchurch (£23,000); city engineer and Air Ministry. 84 houses, Speedwell estate; city engineer. 32 houses, Somermead; Greenhill & Low, Ltd. 200 houses, Southmead estate; rehousing scheme, Vale Lane, Bedminster; city engineer.

BROMBOROUGH (Cheshire).—Woodslee elementary school (400 places); county architect, Newgate Street, Chester.

BROMLEY.—Extensions, County School for Girls; Kent Education Committee.

CARLISLE.—Offices, Caldcotes, for Carr & Co., Ltd., biscuit manufacturers.

CHATHAM.—Adapting buildings at Fort Pitt for day training school; Kent Education Committee.

CHESTERFIELD.—Estate development off Chatsworth Road; J. H. & F. W. Green.

COVENTRY.—Public abattoir (£33,955), for the T.C.; E. H. Ford, city engineer. Nurses' home (£31,500), with heating and hot-water services, &c., Gulston Road hospital; C. Redgrave, architect, Hallam & Co., builders.

CROYDON.—School, Lodge Road (£32,000), for the borough E.C.; John G. Gray, builder, Coventry. Extensions Waddon schools (£20,350), for the borough E.C.; director of education.

DARTFORD.—Two central schools, for Kent E.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

DONCASTER.—Housing scheme (36), Armthorpe and Rossington; surveyor to R.D.C.

DORCHESTER.—Extensions, isolation hospital; borough engineer.

EDINBURGH.—Employment exchange (£9,000); Commissioners of H.M. Works and Public Buildings. School (700 places), Saughton (£30,000); architect, Education Authority.

EPSOM.—Extensions, Manor Asylum (£29,253); W. H. Gaze and Sons, Ltd., Kingston.

FIFESHIRE.—School, Buckhaven, for Fife Education Authority; master of works, Education Offices, Kirkcaldy.

GLASGOW.—Buildings, for Commercial Union Assurance Co., Ltd., St. Vincent Street and Wellington Street; Frank Burnet & Boston, architects. 744 houses, for Corporation; architect, City Housing Department. Church in Dumbarton Road, for Baptist Union of Scotland; the secretary. Extensions, for Scottish Ice Rink, Ltd., Crossmyloof; the manager. Conversion of Union Bank into county offices, for the C.C.; clerk.

HEBDEN BRIDGE.—New St. John's Church; Sutcliffe and Sutcliffe, architects.

HALIFAX.—Pavilion and extensions to administration block at Shelf sanatorium; borough engineer, Crossley Street. Tenders to P. Saunders, town clerk, Town Hall, June 7th (deposit £1 1s.).

HIGH WYCOMBE.—Cinema, Castle Street, for the Majestic Theatres Corporation.

HODDESDON.—Wesleyan church hall, with electrical and heating work; Smee & Houchin, architects, 58, Fleet Street, London; Ekins & Co., Ltd., builders, Hertford.

HULL.—Extensions, Technical College, Park Street; Education Committee. Warehouse, Foster Street; British Extracting Co., Ltd. Municipal aerodrome, Hedon racecourse; city engineer.

HUNSTANTON.—Cinema; Allflat & Courtney, architects, Hill House, Tuesday Market Place, King's Lynn.

KIDDERMINSTER.—Works extensions, Mill Street; Carpet Trades, Ltd. Park Lane: Carpet Manufacturing Co., Ltd. Birmingham Road: W. R. R. Adam, Ltd.

KNUTSFORD.—Alterations and extensions to hospital administrative block, Bucklow Institution (deposit £2 2s.); W. Kennedy, architect, 14, St. Peter's Square, Manchester.

LEAMINGTON.—Estate development off Wathen Road; Standbridge & Parker. Estate development off Radford Road; Aneley & Son, builders, Coventry.

LEICESTER.—Baptist church, Aylestone; trustees.

LENHAM.—Extensions, sanatorium (£7,000); Kent C.C.

LICHFIELD.—Extensions, grammar school, for Staffs. E.C.; education architect, Stafford.

LONDON (East Ham, E.).—School, Altmore Avenue, for the borough E.C.; director of education.

(Eltham, S.E.).—Shops and dance hall, High Street; G. S. N. Stone, architect, Staple Inn Buildings, W.C.

(Penge, S.E.).—Secondary school, St. Arvans; Kent Education Committee.

(Westminster, S.W.).—Theatre, 44-5, Charing Cross; E. A. Stone, architect.

(St. Pancras, N.W.).—36 tenements, Clarendon Street (£20,000); borough engineer.

MACCLESFIELD.—Institution for mentally defectives, Cranage Hall estate; county architect, Newgate Street, Chester.

MANCHESTER.—Library; city architect, Town Hall. Premises, Market Street; Rylands & Sons, Ltd. Alterations and additions to Moston municipal school (deposit £1 1s.); director, Education Offices, Deansgate.

MARLOW.—Additional 40 houses, for the U.D.C.; H. C. Paine, surveyor.

MILNTHORPE.—Domestic subjects centre, for Westmorland E.C.; A. Knewstubb, architect, St. Andrew's Chambers, Penrith.

OSSETT.—Extensions, Moorcroft Mills; Hepworth Bros., Ltd.

READING.—Shops and offices, Friar Street and Blagrave Street, for H. G. Blagrave.

ROTHERHAM.—Housing scheme (40), Thrybergh, for the R.D.C.; C. O. Rawstron, engineer, Grove Road, Moorgate (returnable deposit of £2 2s.).

ROWLEY REGIS.—Housing scheme (284), for the U.D.C.; surveyor, Old Hill, Staffs.

RUNCORN.—Housing scheme (100), Weston, for the R.D.C.; J. Beckett, surveyor. Houses (40), Halton, for the Chemical and Metallurgical Corporation, Astmoor.

SALISBURY.—Electric lighting installation, municipal offices, for the T.C.; city surveyor.

SOUTHPORT.—Council school, Birkdale (deposit £2); Grayson & Barnish, architects, 606, Royal Liver Buildings, Liverpool.

STOCKTON-ON-TEES.—Houses (63), Norton, for the Synthetic Ammonia & Nitrates, Ltd.

STRATFORD-ON-AVON. — High School; Warwickshire Education Committee.

SURBITON.—Housing scheme (500), for J. Williams, trading as the Allied Building Corporation.

STROUD.—Extensions, central school (320 places), for Gloucestershire E.C.; H. W. Household, secretary, Shire Hall, Gloucester.

UPMINSTER (Essex).—Cinema (£25,000), for Louis Morris; W. F. Blay, Ltd., builders, London and Dartford.

WINCHESTER.—County office extension, for Hampshire C.C.; Winchester Castle Committee.

WREXHAM.—Electric lighting installation, Huntroyde estate housing scheme (36 houses), for the T.C.; J. W. Williams, borough electrical engineer, Willow Road.